PRACTICAL WARFARE

Chapters on Armies and Navies in Action

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THE AEROPLANE'S VALUE IN NAVAL WARFARE

A Russian battleship photographed from the sky, the tail of the aeroplane showing at the left of the picture

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CHAPTERS ON ARMIES AND NAVIES IN ACTION

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THE DAY'S WORK OF A SOLDIER

"My three brothers are in the army," said the head waiter. "I hear nothing from them; they may be dead; but if they are living they march, march, march for France. Thirty-six men went from this restaurant to march for France. That is the soldier's work, to march.

"The great Napoleon won his victories because the Grand Army could outmarch the enemy. It is the same to-day. War never changes. Only weapons are new. Yet it is not always the weapons, but the men who handle them, who win victories.

"It is the same in times of peace. I served my time in the army. We marched. As soon as we were mustered in we began to march. At first the distance was short; but each day the road was longer. Soon it was nothing for us to start at 5 o'clock in the morning and march thirty kilometres (eighteen miles) in the forenoon. In the spring and at the manœuvres we marched forty to fifty kilometres (twenty-seven to thirty-one miles) a day for several days in succession. Our crack regiments could do better than that; oh, much better. Yes, and we always carried our full kit—rifle, knapsack, ammunition and all—about fifty-five pounds. Besides, we carried wood for

our fires. That was quite a different matter from a saunter for pleasure without a burden.

"In passing through a town we closed up our ranks, got in step and the band played. In the country we marched at ease, not trying to keep step, carrying our guns as we wished, on either shoulder or by the strap. We unbuttoned our collars. We chatted and joked, for the Frenchman is light-hearted. The officers fraternized with us, for in France all are equal. I have seen our lieutenant take the knapsacks of two men at once who were showing signs of falling out from exhaustion, and carry them for five hundred yards, at the same time encouraging the men to brace up.

"We sang a great deal, the officers joining us. We sang 'Panpan l'Arbi,' 'Sambre et Meuse,' which is a fine march that our fathers sang in the dark days of 1870. Also we sang, 'As-tu vu la casquette du père Bugeaud?' That was about a general who lost his helmet in a fight with the Arabs. And we sang, 'J'ai perdu la clef de "fa" de ma clarinette.' That was just a jingle of nonsense—'I have lost the "fa" key to my clarinette.' Then the next time it would be, 'I have lost the "sol" key to my clarinette,' and so on for every note in the scale. Then back to the beginning, and all over again, roaring it out as if it was the most solemn thing in the world."

Now the French are singing a song they learned from the English, "C'est loin d'ici a Tipperary." It begins, "Adieu, Piccadilly, adieu donc Leicester Square."

To this they are marching in dead carnest, for

although the retreat to Paris and the subsequent advance may have seemed slow on the map there was many a French regiment doing twenty and twenty-five miles a day in full marching order and fighting in between-whiles.

This means that every man turns himself into a pack animal. Every infantryman is loaded with fifty or sixty pounds of kit, including his rifle, entrenching tool, extra clothes, cooking equipment, etc. A healthy man unencumbered can walk four miles an hour. It is a good gait. But a soldier loaded with a third of his own weight and moving in large bodies does very well if he averages two and a half miles an hour. Where roads are narrow or bad the men in front delay those behind, and almost always there is mud or dust to contend with. The dust of thousands of shuffling feet, of men and horses, can be a blinding, choking cloud that adds much hardship to a march ; and in mud the weight and balance of a pack makes marching a constant strain. In the bad roads in Manchuria the Japanese soldiers, men 5 feet 3 inches high, carrying a fifty-five pound load, did not make more than two miles an hour.

" The hardest work a soldier has to do, and the most of it," said an Englishman who saw service in the Boer War, " is marching.

" British army authorities attach great importance to fitting each man properly with boots, but even so, if you are not both careful and lucky your feet get sore, and then life is prolonged misery. I always carried a piece of soap on the march with which I soaped the bottom of my socks outside each morning before starting, unless

we were routed out in too great a hurry. It was the best preventive of sore feet I have found.

"The worst feature of marching in the Boer War was the thirst, for the heat and the dust together seemed to set a man on fire. There wasn't always a running stream at hand whenever you wanted a drink. Besides, drinking isn't good for a man while on the march. The officer who knows his business will not allow his men to drink much while on the road. They take a drink before starting, and they can drink all they please when the day's march is done. Between-whiles the contents of the water bottle are only used for gargling the mouth.

"The occasional fights were a positive rest between marches. I do not mean to say that I enjoyed a battle, but there was some physical relaxation."

That marching really bulks as large in the soldier's day's work as these men, speaking from the abundance of experience, asserted may be gathered from paragraph 331 of the Field Service Regulations of the German army:

"Marching constitutes the greater part of the work performed by troops in war. The success of every operation depends upon the unfailing execution of marches."

Other nations impress this precept upon their soldiers, though none, perhaps, so zealously as France. The endless practice marching is not merely to be able to get over the ground but also to develop powers of endurance that will be needed in battle. The larger the body of men on a march the slower their gait. Under ordinary

circumstances, when no urgent need for speed exists, twelve to fifteen miles is considered a fair day's work.

When the infantryman is not marching he is usually digging, for it has become more and more the custom for armies to entrench every position which they occupy in the face of the enemy, even if the positions are to be held only for a short time. In the 125-mile retreat from Mons to Paris, it is a fair assumption that there were many men in the British Army who did not spend a waking hour, except when they were under fire, without marching or digging. There are literally hundreds of miles of trenches dug, by both armies along the Marne, the Aisne—everywhere that troops have stopped. Most of these trenches are deep enough for a man to stand in and only wide enough to give him room to use his gun.

An infantry soldier when not actually under fire is a cross between a pack animal and a day labourer. And the citizen soldiers of France and Germany have had to work hard to become proficient in marching, in trenching, and in fighting and all the things which must be done to keep efficient.

Every able-bodied German is potentially or actually a soldier, and yet, except for the officers, there are no professional soldiers in the whole giant military empire. We speak loosely of Germany's immense standing army, yet Germany's permanent fighting force is a negligible quantity. The German army is constantly changing in personnel and is permanent only in that it is constantly renewed and is built up about a per-

manent equipment and under permanent officers. The German army is the German nation in arms.

In the training, the new recruit, whatever his station in life, is at first given menial tasks. His first military duties may be that of boot-black or scullion. He is learning his first lessons in discipline—the primary principle of the whole great system.

He is then taught how to stand. There is just one right way to stand, and the recruit must master that if it takes a week. If he has grown a bit one-sided from working at a desk, so much the worse for him. Then he is taught how to walk with equal precision; all mannerism must disappear from his gait and his muscles must conform to the regulations.

At length he is instructed in marching, simple evolutions, and the famous and much ridiculed goose-step. It is probable that this step is a survival of an ancient custom founded on an actual need. The Macedonian phalanx, the Roman legions, and all military bodies which were trained to advance in extremely close formation, must have developed some sort of special lock-step to avoid treading on one another's heels. At any rate, Frederick the Great introduced such a step for that purpose, and it is this which has been handed down to the present day together with other treasured military customs and traditions and the persistent tendency toward the close formation in an advance. The goose-step is to-day used as a sort of salute; when a group of soldiers pass an officer they immediately fall into this unnatural and by no means easy gait. It is also perpetuated

because of its practical value as an exercise for strengthening the muscles of the leg.

The regular infantryman in the German army receives the munificent salary of 2¾d. a day. His uniform and accoutrements are furnished by his Government, but he has to supply his own luxuries —his tobacco, extra food, shaving materials, and shoe polish. Every four days he is given a large loaf of coarse black bread which is seldom eaten until the soldier learns to realize the pangs of keen hunger. Every morning he is given a cup of black coffee and a roll; butter and sugar he must provide for himself. At noon he receives meat and vegetables in moderate amount, or a meat stew. In the evening soup is served which helps to soften the black bread. The majority of German soldiers, however, are able to prepare in advance to relieve these hardships by saving money for an occasional change of diet.

In war times the soldier has usually plenty of sustaining food of the same general character. Travelling field kitchens keep up with him on the march and give him a hot meal at least once a day. Yet once in a while the commissary breaks down and the fighting, digging, walking private eats his emergency ration and then goes without. Many of the German stragglers who were caught by the French advance from Paris were footsore, hungry, and worn out.

This present war has not gone on long enough to bring the soldiers down to the final low level. They have not yet gone into dug-outs or huts for winter quarters. Medical science now prevents the scourges of typhus and dysentery that used to

sweep through camps, but it has not yet got rid of the dirt and vermin that are likewise incidents of prolonged camp life. The marching, entrenching, picket duty, monotonous food, discomfort, and uncleanliness make up much of the day's work of a soldier. The occasional excitement of battle and the knowledge that he is part of the most interesting game for the highest stakes in the world—this and the good comradeship, make up for the otherwise squalid existence. The grim realities of everyday soldiering are chiefly hard work and discomfort. The part that flares up in the headlines are the exceptional days to which all the toil and preparations are dedicated.

Even when this final test comes the demeanour of soldiers in battle is astonishingly simple. In the words of one who has been many times under fire:

"He who expects to see something out of the ordinary, something heroic, on his face at these decisive moments, something picturesque and dramatic, is greatly mistaken. The soldier remains the same ordinary man as before, only his face is somewhat paler and its expression more concentrated and serious. His nervous and rapid firing betrays the inner struggle."

The principal characteristic of modern battlefields is the invisibility of the enemy.

"When I went into battle for the first time, I could determine the direction and position of the enemy only by the whistling of the bullets, although I was with my company under shrapnel and fierce rifle-fire. When I reached the crest of the hill, I began to scan the horizon to see whence that hail of fire was showered upon us.

"I looked in vain for traces of trenches or fortifications and expected to see somebody. I saw nothing and nobody. I was told but one thing before the battle: 'Occupy the hill to the right.'

"Scanning the locality I saw at a distance, 1750 yards, a long wavy range on which it seemed that there was not a soul, and yet it was from that point that the bullets were flying. We determined the approximate range of that hill and opened fire against it.

"This invisibility brings about a sense of insecurity and irresolution. It often happened that a man passed several days on a position and was put *hors de combat* without having seen the enemy.

"Another peculiarity lies in the long distance at which the shots tell. A unit, separated from the enemy by a range of hills, begins to incur losses at a distance of several thousand yards. Before that unit opens fire and can at least see the hills from which it is being fired at, it has already become somewhat disorganized materially and morally, and consequently cannot go into battle perfectly fresh. It is sometimes necessary to remain for several hours under such preliminary fire, whence arises fatigue, both physical and moral, long before the period of actual combat.

"The duration of modern battles, sometimes reaching several weeks, imposes a terrible tension on the mind, and acts exhaustively upon the physical condition of the men. A great supply of moral and physical strength is needed to stand for several days uninterruptedly the conditions of life in positions. The conditions of that life are such

that one must fire, drink, eat, sleep, and die without knowing one minute's rest, by day under fire, and by night under the nervous strain of expecting a sudden attack at any moment, in utter darkness, sleepless, not being able to light even a cigarette without drawing a hail of bullets at each flash of the match.

"Add to this constant losses in wounded and killed. The base of the hill in a few hours after the occupation of the position is covered with fresh burial mounds and their number grows with every day that the campaign continues.

"It is difficult to depict in words the impression made upon an inexperienced man by battle. The first projectile bursting alongside or the first bullet hurtling past awakens such varied feelings and impressions.

"Modern rifle-fire produces a strong impression: the air seems to be literally filled with bullets; their plaintive whistling pervades the atmosphere like a continuous moan, above, below, and everywhere.

"As soon as the first shot is heard, the soldiers grow serious; jokes and conversation cease. At the given order all march bravely as during manœuvres.

"The courage and calmness with which the soldiers go into battle produce a strong impression.

"The infantry soon grows accustomed to rifle fire, but the artillery fire, especially the shells, produce a decided impression. It seems to me that this is not due so much to the losses inflicted by artillery as to the ear-splitting noise produced

by the explosion of the projectiles. The effect is produced only on the ear, but it is strong. The shells have a specially powerful effect upon the inexperienced, and the shrapnel upon those unaccustomed to battle. The young soldiers throw themselves face downward at each bursting of a shell. Thus the infantry, which suffers most from rifle fire, pays least attention to it; the artillerymen, on the contrary, are much impressed by rifle fire. This may be explained by the fact that the men are accustomed to their own arm. In addition to this, the whistling of the bullets also produces an impression upon a battery, because it notifies the artillerymen of the approach of the enemy and consequently of danger."

Even when he is hit the soldier is apt to take it as other men take the lesser misfortunes of other businesses. An officer whose cheek was torn off by a fragment of a shell remarked, "Thank God I don't feel as bad as I look." An Irishman received a flesh wound. "Ah, the brutes have hit me," he said. "Here's wan back at thim." Almost as he fired he received a second wound. "Well, if they haven't done it again." Then a third bullet struck him. "That's number three. The blackgyards might lave a party alone after they've hit him wance. I'll teach thim better manners." Thereupon he emptied his pouch at the enemy before his wounds got the mastery.

How to march, how to entrench, how to live in camp without getting sick, how to fight in open order, how to spend a week in the trenches under shrapnel fire—these things are a normal part of the soldier's day's work in war time.

A WAR OF UNSEEN ARTILLERY

HOW GUNNERS FIRE WITH DEADLY ACCURACY AT ENEMIES WHOM THEY CANNOT SEE : HOW THE FRENCH REVOLUTIONIZED ARTILLERY PRACTICE

INFANTRY now is much the same as it was twenty years ago. Cavalry is much the same as it used to be. But artillery is different, and this is more of an artillery war than any that has preceded it. When the French artilleryman attempted to stop the Prussian advance forty-four years ago, he placed his gun on a hill, waited until he could see the enemy, aimed at him, and fired. Now he places his gun behind a hill where he cannot see the enemy and the enemy cannot see him, shoots into the air at an angle and in a direction given him by his officers, and hits the Germans much more often than formerly although the Germans are now much farther away—perhaps two or three miles.

The artillery arm in warfare has radically changed. The guns used in the American Civil War were simple tubes of metal loaded generally from the muzzle and mounted rigidly on an axle between two wheels. Every time the gun was fired the carriage ran back a considerable distance and the cannoneers had to push it forward again to the firing-point. Hence the fire was necessarily

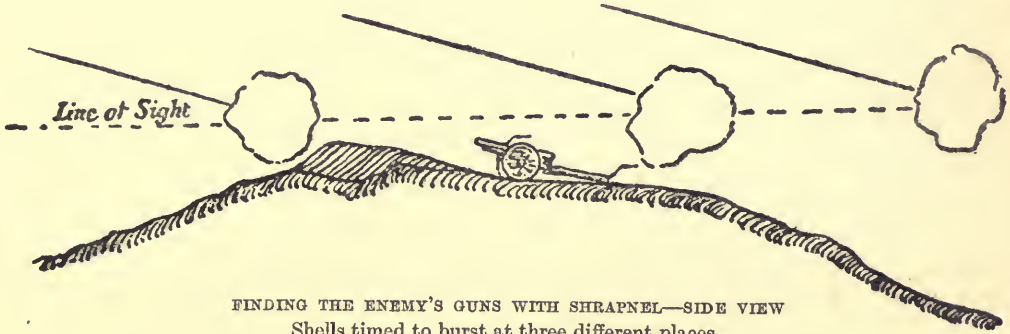
slow. The sighting devices were crude, but as the range was rarely as much as a mile they were sufficiently good, perhaps, for the weapon with which they were used. In the period from 1865 to 1900 guns became gradually more powerful and efficient, but no very radical improvement was made. About 1900, however, the French succeeded in revolutionizing the gun-carriage and sights and so the method of using artillery. The gun of to-day, instead of being fixed rigidly to its carriage, is attached to one or more recoil cylinders mounted on the carriage. When the gun is fired the carriage stands fast while the gun alone slides to the rear ; the energy of recoil being gradually taken up by the resistance which liquid in the recoil cylinder offers to the movement of a piston, and by the compression of springs or air, which latter then serves to return the gun to its firing position after the recoil has been checked. As the carriage has not moved, the gun—almost instantly returned by the springs—is still directed on the target, and can be fired with great rapidity—twenty aimed shots a minute if necessary by guns of 3-inch calibre.

The sighting device is so arranged that the gunner can aim either directly at a given point, or at any angle away from that point given by the captain. This is of great importance for, in general, the captain designates as an aiming point some prominent object which all the gunners can see, and gives the gunners the angle which they must set off on their sights so that, when the line of sight is directed on the aiming point, the gun will be directed at the enemy. This may sound rather complex, but it is not really so, though

diligent practice and training are required to attain the necessary skill and quickness. The angles may be measured with sufficient accuracy by means of a graduated ruler held by aid of a string at a fixed distance from the eye.

The introduction in the last few years of long-range, accurate, quick-firing guns has greatly affected the manner of serving artillery. In the early part of the Manchurian War the Russian artillery taking positions in the open in the old way, suffered great losses from the fire of concealed Japanese artillery. The results of this war, confirmed, it seems, by those of the recent Balkan War, have been to cause military men generally to regard the concealed or masked position as the normal one for artillery. This means that the guns are hidden by a crest, or by trees, or standing crops while the captain, placed so that he can overlook the field of action, gives the data for aiming the guns so that their fire will reach the desired target. Hence the artillerymen have only the mechanical duties of setting fuses, loading, aiming, and firing the gun according to the captain's commands; and, with the equipment now provided, it is possible for the captain to direct the fire of his guns quickly and accurately on almost any target in range and vision. He can shift the fire from right to left and, by minor changes in the angle as used by the different guns, he can cause their fire to be converged or distributed as he sees fit. A skilful captain with a well-trained battery has the fire almost as readily under his control as has a fireman of the stream of water from his hose. The communication between a

FINDING THE ENEMY'S GUNS WITH SHRAPNEL—FRONT VIEW
Showing one shell bursting in front of the battery and one behind, thereby fixing the position.



FINDING THE ENEMY'S GUNS WITH SHRAPNEL—SIDE VIEW
Shells timed to burst at three different places.

captain and his gunners is the weak link; for the captain may have to separate himself considerably from the guns in order to see the target, and then has to rely on telephones, signals, or a chain of orderlies to transmit his commands. Of course it is not to be presumed that the guns should always be placed under cover. If the conditions require it they may be placed in the open.

Whether concealed or in the open, whether using indirect or direct laying, the procedure of adjusting the fire on a target is much the same. The captain causes a salvo of two or four shots to be fired, using the range obtained from the range-finder or his own estimation: let us say 3000 yards. When the guns are fired he sees two or four burst somewhere near the target. He observes, let us suppose, that they are to the right of the target and short of it. He orders another salvo to be fired, that is directed the necessary amount to the left and with a range or elevation greater by 400 yards than the range last used. Say that this is good for line but over the target. He then fires a third salvo at the mean of the preceding two or, in other words, at 3200 yards, and if this should be observed as striking beyond the target, he would then know that he had his target "bracketed" between 3000 and 3200 yards; and if the target consisted of troops in the open, and hence liable to move, he would probably proceed at once to search this 200-yard area by firing salvos at 3000, 3100, and 3200 yards until he could make sure which was the most effective range.

The captain has other things to do, namely, causing his time fuses to be adjusted so that the

shrapnel will burst at the proper height, and varying the direction of his different guns so that their fire will properly cover the part of the hostile line he has to attack. But the description above gives an idea of the processes involved. In the performance of his duties the captain may have assistants posted in favourable positions to observe and signal how near the shots are falling to the target; and observers in aeroplanes or dirigibles may likewise be used to assist him in adjusting the fire on targets so well concealed that he cannot see them at all.

Field artillery includes light artillery, horse artillery, mountain or pack artillery, and heavy or siege artillery.

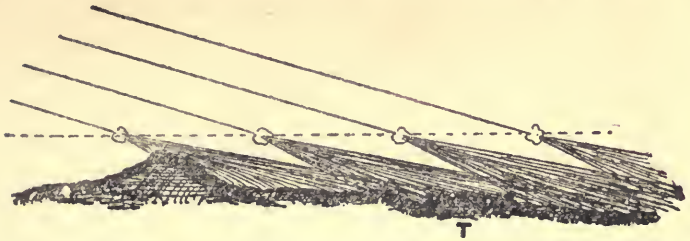
Light artillery constitutes by far the greater proportion of the artillery accompanying field armies. Its principal weapon is a gun of about 3-inch calibre, firing a projectile weighing about 15 pounds. The gun and the caisson (carrying ammunition) are each drawn by six horses, and these vehicles are presumed to be sufficiently mobile to accompany the infantry in almost any ordinary kind of country. The 3-inch gun is the one principally employed for the reason that it is the best compromise between the conflicting considerations of power and mobility. Moreover, it is able to meet most of the requirements of the ordinary battlefield. When special services are required, such as breaching heavy fortifications or reaching an enemy at very long ranges, the heavy guns have to be dragged up.

Horse artillery is intended especially for service with cavalry. The equipment is very similar to

that of light artillery, but means are taken to reduce weight so that six horses can draw the two vehicles and keep up with cavalry in long, fast marches. In light artillery the men who serve the guns ride in the carriages, and thus add to the weight to be drawn by the horses; but in horse artillery every man has a horse to ride.

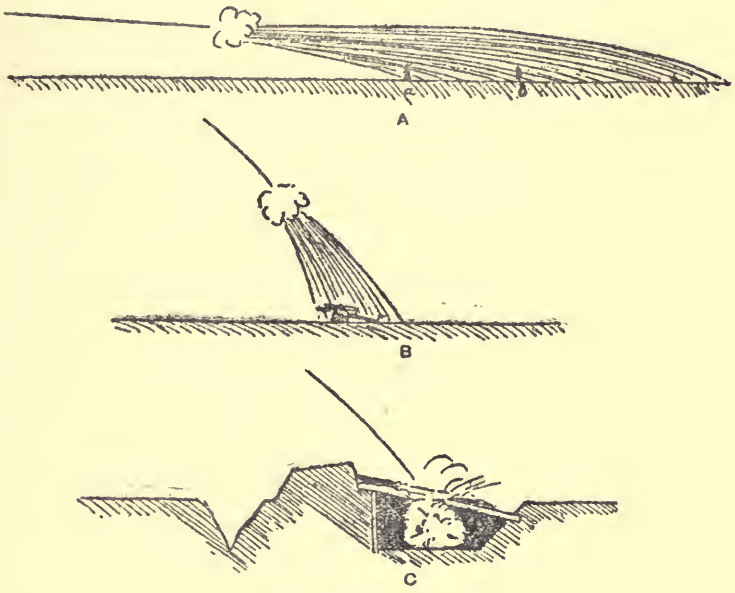
Mountain or pack artillery is devised especially for service in difficult country: in the mountains or in the jungles of the tropics, where the trails are not adapted to the use of wheeled vehicles. Most of the nations of Europe have provided themselves with a small proportion of mountain guns for such services. The guns and all the equipment are packed on the backs of mules, each mule carrying a load of between 250 and 300 pounds. For travel, the gun and its carriage are dismounted and the parts are loaded on five different mules. With skilled artillerymen the loading and unloading can be effected with great speed. Due to the ease with which this type of artillery can cross any kind of country and take advantage of cover it is especially adapted to the close support of infantry; but, owing to the limitation on weights, it is necessarily a less powerful weapon than that used by the light and horse artillery. The weight of the projectile is approximately the same, but it is fired at a much lower velocity.

Heavy or siege artillery are the larger calibre guns, howitzers, and mortars used to destroy material objects such as fortifications, and to supplement the fire of light guns in the attack of



COVERING THE GROUND

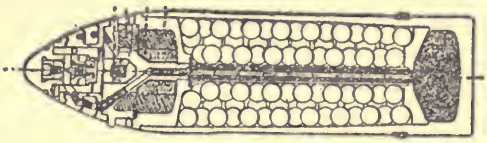
How shrapnel may be fired simultaneously to cover territory where troops are concealed.



BURSTING SHRAPNEL

"A," shrapnel from a high-power gun properly timed attacking infantry in the open. "B," shrapnel fired from a howitzer against artillery. "C," shrapnel bursting on impact and reaching troops protected by overhead cover.

troops at specially long ranges or well protected in entrenchments. A variety of calibres are used by different nations for these purposes, ranging from guns and howitzers of from 4- to 6-inch calibre, firing projectiles from 40 to 120 pounds in weight, up to howitzers and mortars of 11-inch calibre, firing projectiles weighing as much as 800 pounds. The lighter calibres are hauled by teams of eight



HIGH EXPLOSIVE SHRAPNEL

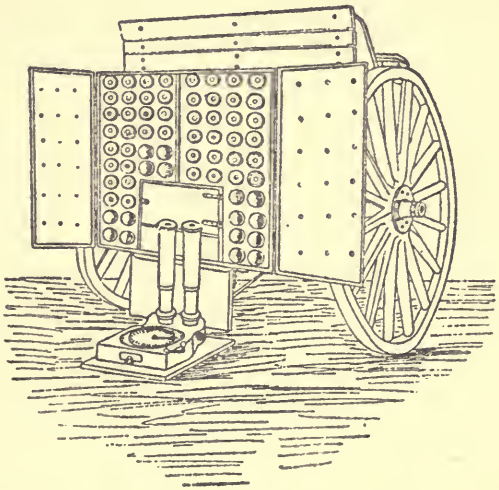
If the time fuse is set the projectile bursts in air, the base charge driving out the bullets which scatter and give the shrapnel effect; otherwise the projectile bursts on impact.

horses as a rule; the heavier calibres are transported by rail as far as possible, and are then drawn by some form of traction engine or by horses.

In action a field-gun and its caisson carrying ammunition are placed side by side, wheels almost touching. Both vehicles are provided with shields which serve to give almost complete protection from infantry fire. On seats attached to the piece two gunners keep it trained for direction and for range as prescribed in the commands of the captain, while other gunners, kneeling behind the caisson, set fuses and pass the cartridges to a man who feeds them into the gun as fast as it is fired.

If the guns are skilfully posted in the beginning

their great range and the ease with which fire may be shifted from place to place permits their fire being brought to bear on many parts of the battle-field without frequent changes of position; and with accurate means of communication established



A CAISSON OR AMMUNITION WAGON

Which is set by the side of the gun in action. The device on the ground is a mechanical fuse setter by which the point of the explosion of the shell in the air can be regulated.

the higher artillery commanders can cause the fire of groups of artillery to be converged on one point or distributed as necessity dictates.

The 3-inch gun, the one which constitutes the bulk of the equipment, is very effective at ranges up to two miles, while up to three and a half miles it may still be expected to accomplish very considerable results. The heavy guns and howitzers of medium calibre, say about 6-inch, are very

effective up to three and a half miles and may be used to advantage up to five miles. The large guns used in siege operations, say of about 11-inch calibre, are effective up to five miles, but even at this range difficulties of observation will often make accurate adjustment difficult.

Guns of Various European Nations

There are no essential differences in the *light* artillery equipment used by the principal European nations at the present. The same could not have been said twelve years ago, however, for the French had then just succeeded in making a notable advance in artillery equipment. They had devised the gun recoiling on its carriage described above and had learned to use it from concealed positions, employing indirect fire. Other artilleries were still provided with the old rigid type gun-carriages and they still expected to use their guns habitually more or less in the open, with direct fire. It seems unquestionable that the French would have had a great advantage at that time. But now all nations have followed the French lead and though some types may be better than others, no very great advantage can be claimed on the score of light artillery equipment. It is skilful handling which must determine on which side the advantage lies.

In the improvement of heavy or siege artillery equipment progress has been much less uniform. As the efficiency of the light field-gun has increased the tendency has naturally been to begin actions at longer ranges and to use cover to a greater and greater extent. The desire for larger and

heavier calibres has thus been on the increase. The Japanese brought mortars of the larger size (11-inch) to bear on the defences of Port Arthur; and possibly as a result of this experience the Russians have provided themselves with a howitzer of this same large calibre, firing a shell weighing about 800 pounds. This mortar is transported in the field on four separate vehicles but is capable of being mounted and dismounted within an hour's time. The Germans have devoted themselves specially to the provision of heavy equipment. Knowing that land forts lay in their path it seemed natural to provide guns adapted to destroying them. The heavy guns principally in use by the Germans are, according to the public prints, a 6-inch howitzer, firing an 88-pound shell, with a maximum range of about four and a half miles; and an 11-inch howitzer, firing a 750-pound shell, with a maximum range of about six miles. The latter is probably the weapon which the newspapers have so often referred to in connexion with the attack on the forts of Liège and Namur; and the former is probably the heavy howitzer frequently referred to in the daily papers as being used by the Germans in the battles on the Marne and the Aisne. Each army corps is understood to have sixteen of these weapons.

The French have for some time been discussing in their military literature the pros and cons of heavy artillery equipment. They have not apparently as yet adopted guns or howitzers of the heaviest calibre. Their only heavy equipment appears to be a 6-inch howitzer firing a 95-pound shell with a maximum range of about four and

a half miles. Each French army corps is reported to have twelve of these weapons when on a war footing. The English have with each infantry division four heavy guns firing a 60-pound shell.

Organization of Field Artillery

The organization of field artillery varies considerably in different armies, but the general plan followed may be briefly described. The organization comprises batteries, battalions, regiments, and brigades.

The battery is the unit specially charged with the delivery of fire. The higher artillery commanders deal particularly with the tactical employment of artillery; the battery commander deals particularly with the technical duties involved in bringing fire to bear, though of course he is liable to have tactical duties, too. The battery comprises from four to eight guns, depending upon the country involved. France has four guns to a battery, England, Germany, and Austria have six, while Russia has eight. The battery equipment also comprises from eight to twelve caissons, or ammunition wagons, carrying approximately 100 rounds each. It has a captain, from two to four lieutenants, and about 175 men.

The battalion (called by the English "brigade" and by the French "groupe") comprises three batteries. It is commanded by a major or lieutenant-colonel who has a staff of officers and men charged with the duty of securing information and of communicating it to the battery commanders. The regiment comprises

two, three, or even four battalions. It is commanded by a colonel who has a staff similar to that of a battalion commander and provided for similar purposes.

The brigade comprises two regiments commanded by a brigadier-general.

For service with the other arms a brigade of light artillery or the equivalent thereof is generally assigned to each infantry division, while a regiment of horse artillery is assigned to each division of cavalry. The heavier guns being intended for special services are generally assigned by battalion or regiment to army corps or field armies as needed.

Ammunition

Two types of projectiles are generally employed, shrapnel and shell; though several armies are now using a single type projectile, called a high explosive shrapnel, designed to embody the qualities and effects of both shrapnel and shell.

The form of all projectiles is approximately the same, namely, that of a hollow steel cylindrical case with pointed head, having a soft metal band near the base which takes the rifling of the gun and gives the projectile the twisting motion which keeps it steady during flight.

The shrapnel has a combination time and percussion fuse. If the time fuse is set for a given range a train of powder starts to burn as the projectile begins to move from the gun, and flame is thus transmitted to a charge of powder located in the base of the projectile which explodes and bursts the projectile in the air at the desired

distance from the gun. In front of the bursting charge is a mass of about 250 round bullets which at the moment of burst are, along with the pointed head, driven out of the front of the cylindrical case. The case remains intact and thus acts as a little mortar, discharged up in the air in front of the troops to be attacked. The bullets, after leaving the case, spread out and, if the burst occurs at the proper height from the ground, they should search very effectively an area about 20 yards wide and 150 yards deep. If the time fuse is not set, or, if it fails to act, the percussion fuse acts automatically when the projectile strikes the ground; but the effect produced is then far more localized than when the burst occurs in the air.

The shell has a percussion fuse only, as a rule, though certain nations, notably the Germans, have a shell with a time fuse too. The walls of the case are much thicker than the case of a shrapnel, and the bursting charge is a high explosive instead of ordinary powder. At the moment of burst the case is ruptured into many killing fragments, though unless the burst occurs on very hard, stony ground the effect is apt again to be very local.

Shrapnel is intended especially for the attack of troops in the open and more or less exposed. Shell is intended especially for the demolition of material objects such as artillery material, walls, buildings, etc., and to reach troops protected by such objects. It may be said that shrapnel is the principal projectile of the lighter guns and shell is the principal projectile of the heavier ones.

A fairly good picture of the effect produced on the minds of soldiers by this fire, reaching them

from they know not where, is given in the following extract from a soldier's letter in an English newspaper :

" The Germans are now up to all sorts of tricks to hide their batteries, and much of their effect is due to the fact that shells drop about your ears when you are least expecting them. It is a favourite trick to keep a battery well masked for hours and then, when our infantry are deploying within range, without the least notion of what is coming, the German shells begin to fall around like the autumn leaves. That's very trying to the nerves, or was at first, but we are now getting used to it."

Tactical Employment of Field Artillery

The rôle of field artillery is to assist the infantry. Artillery alone cannot win battles. To rout and disperse the enemy infantry must advance and close with him. On the other hand, infantry may not be able to advance unless the enemy's fire is kept down. So the two arms have to work together in complete mutual understanding and close co-operation in order to accomplish decisive results. To illustrate this, the attack of an infantry division on a hostile position may be outlined. (The European division comprises approximately 12,000 infantry and from 36 to 72 guns.) The advance guard in the division may be presumed to have gained contact with the enemy and to be pushing forward to gain a favourable position and to determine as closely as possible the dispositions of the enemy. The advance guard artillery is supporting this movement and endeavouring to draw the fire of the hostile

artillery so as to locate their positions. Artillery reconnaissance officers are studying the hostile ground, noting on rough panoramic sketches what can be determined of the enemy's positions, especially that of his artillery, and examining the approaches to the hostile territory for suitable positions for their own artillery. Aeroplanes and mounted scouts are assisting in this work. The division commander explains to his chief of artillery his plan of attack. The chief of artillery, accompanied by his regimental and battalion commanders, rides forward, receives reports of reconnaissance officers, and assigns duties and positions to his subordinate tactical commanders. The latter make detailed studies of the situation, bring up and post their battalions and batteries, assigning specific duties to each. The first duty is to gain superiority of fire over the opposing artillery, and, for this purpose, the fire of groups of guns is converged on each hostile artillery position as it is located. This preliminary work may have to be effected at long range, four, five, or even six thousand yards. Heavy guns may be assigned to the division to assist in it. In the meantime the infantry is advancing under the cover and protection of this fire. It must not wait, for otherwise the artillery may spend its ammunition and not be able to help at the really critical moments which are to follow. Moreover, its advance forces the enemy to reveal himself and thus become subject to effective fire. In former wars the idea prevailed that there should be a distinct artillery duel to settle the superiority of artillery fire before the infantry advanced; but with both of the

opposing artilleries occupying masked positions the combat between them is apt to be a long-drawn-out and indecisive affair. To accomplish results one side or the other must advance. It is to be noted, however, that in the present European war the efforts seem to be made to shake the hostile infantry by a sustained artillery fire before exposing the attacking infantry. Thus, according to the daily papers, Sir John French reports under date of September 24: "The object of the great proportion of artillery the Germans employ is to beat down the resistance of their enemy by concentrated and prolonged fire, to shatter their nerves with high explosives before the infantry attack is on. They seem to have relied on doing this with us, but they have not done so, though it has taken them costly experiments to discover this fact."

Against points where strong resistance is offered to the advance of the infantry, special concentrations of fire are ordered. As the infantry gains ground to the front the artillery will probably move forward, too, such movements being perhaps effected at night and the guns strongly entrenched. Finally the infantry gets close enough for the decisive attack. The division commander selects the part of the hostile position against which he is to mass his principal effort and, as the infantry moves forward, the artillery endeavours to smother this locality with a rain of bursting shrapnel, the great proportion of the guns being used for this purpose, leaving a minor number to keep the hostile artillery in check. When the infantry arrives within one or two hundred yards of the

position, the artillery must shift its fire to reach neighbouring parts of the hostile line, or to reach the enemy's reserves coming up in the rear. While certain groups of artillery attend to these duties, others are pushed rapidly forward to occupy the captured positions, fire upon the retreating enemy, and prevent reinforcements from coming up. Of course, every battle presents its own peculiar set of positions and no rigid plan can be followed. The foregoing is intended merely as an illustration of co-operation between infantry and artillery.

CAVALRY

ITS CHARACTER AND PURPOSE, ITS ARMS AND AMBITIONS : THE MOST SELF-SACRIFICING OF ALL MILITARY UNITS : WITH ESPECIAL REFERENCE TO THE CAVALRY OF THE EUROPEAN NATIONS ENGAGED IN THE PRESENT WAR

THE wonderful sweep of Von Kluck's and Von Buelow's armies across Belgium and down into the heart of France in August was made possible by flying divisions of Uhlans, hussars, and dragoons which scoured hostile territory ahead of slow and inexorable infantry and siege trains. No one knew whence or whither the main bodies of German army corps were advancing because their movements were hidden behind a veritable cloud of German cavalry which spread out over Belgium and Picardy like the onrolling fog which the colour of their uniforms so well imitated. Every German cavalry division, it must be remembered, normally carries with it, in addition to its 4000 galloping troopers, a full battalion of horse artillery, a pioneer detachment with pontoon bridging materials, cyclist companies, and machine-guns. In this campaign they are doing something else brand new. For with each division of cavalry a fleet of fast motor-cars and trucks filled with

infantrymen has followed along the roads with a mobility hitherto unapproached.

Down to the Marne this rush prevailed for the Allies' cavalry were unable to cope with the Germans' overwhelming numbers and their terrific tactics. So these cavalry divisions penetrated quickly to the main bodies of the Allies' armies, unmasked their positions and often, well supported by the prompt approach of crushing infantry columns, made such positions untenable. A great many of the engagements reported during August as battles were merely advanced skirmishes by this screening force of German reinforced cavalry feeling out the way ahead of their main armies whose movements and intentions they effectually concealed.

So far as motor traffic is concerned, such a rush could not be made again, for all Europe is suddenly awake to the military necessity of destroying its magnificent highways in the path of an advancing enemy just as railways have always been destroyed in the wake of retreating armies. But war does not follow the roads alone, and so the efficiency of cavalry will continue where wheeled vehicles, however propelled, cannot go.

All of this informational and screening employment of mounted troops, important as it is, and only performed by continual fighting, appeals naturally much less to popular imagination than those heroic charges of past campaigns which have retrieved lost days, saved retreats from becoming debacles, or resulted merely in glorious self-sacrifice. In this last category belongs the charge of the Light Brigade at Balaklava in the

Crimean War, but in that same battle six weak English squadrons under General Scarlett, by an equally determined but more intelligently commanded effort, threw back a mass of 4000 Russian Cossacks in the nick of time. The charge of Von Bredow's brigade in the battle of Vionville during the Franco-Prussian War is a famous historic instance of cavalry sacrifice saving a battle.

Beyond Vionville that day in an important flanking position lay the remnants of the Twenty-fourth Regiment of German infantry, ammunition low, without supports, and completely exhausted by the extreme heat. A little over a mile away in front of them the whole French Third Division was drawn up in two lines supported by nine batteries of artillery. Later a French cavalry division rode up and joined forces. Now it is almost a military axiom that cavalry cannot charge unshaken infantry. But that is exactly what happened at Vionville. The German commander, realizing that if the French cavalry charged his German infantry would be lost, determined to sacrifice his own cavalry in an effort to anticipate the French. The nearest available force was Von Bredow's Prussian brigade of six squadrons. They went to apparently certain annihilation as the Light Brigade went at Balaklava but to a better purpose. At the command the whole brigade charged in line clear across the intervening distance of two thousand yards under a desolating fire, reached the French first line and, sweeping over it, piled it up on the second. In the mêlée that followed the French cavalry division

rode down on them five to one. Then, says the official account:

"General Von Bredow sounds the recall. Breathless from the long gallop, thinned by the enemy's bullets, without reserves, and hemmed in by hostile horsemen, they once more cut their way through the previously over-ridden lines of infantry and artillery; harassed by a thick rain of rifle bullets and with the foe in hot chase in rear, the remnant of the two regiments of Prussian cavalry hasten back to Flavigny. The advance of the Sixth French Army Corps was checked and was now, by order of Marshal Bazaine, entirely abandoned. At any rate the French made no further advance from Resonville this day."

Von Bredow saved a defeat. Conversely, if the Japanese had possessed any cavalry worthy of the name in Manchuria in 1905 the Russian defeat at Mukden might have been turned into an overwhelming catastrophe. Two efficient cavalry divisions of the kind that swooped from Aix-la-Chapelle to the Marne, might have easily cut off the retreat of the entire demoralized army of Kuropatkin, might thus have made peace at Mukden instead of at Kwangchengtzu some months later, and have won for Japan the indemnity the nation so greatly needed and then deserved.

The most recent and striking example of the heroic self-sacrifice of cavalry in saving situations is that of the Ninth Lancers' charge at Quievrain near the Belgian border on August 3. They rode point blank at a battery of eleven German guns which were shelling the British retreat, reached them, sabred the gunners, and put every gun out

of action. On their way back, however, they were shelled on both flanks and lost all told more than 40 per cent. of their number.

Different Arms in Use

The mounted troops of all the countries now at war are armed very much alike. All of them carry carbines. The American Civil War did that for European cavalry. All of them have sabres also. All the German cavalry regiments, but not all in other countries, are armed with a lance. Only commissioned and non-commissioned officers carry revolvers now. The United States army has never adopted the lance, and cavalry officers in America believe the present war will mark its passing from the armies of Europe. It is interesting, however, to know that Austria in 1863, Russia in 1884, and France in 1871, abolished this weapon. But every one of these countries has now readopted it and is using it in the present war.

The Germans, incidentally, are not to-day and never have been the equals of the French in sabre play. This inferiority in one weapon of assault may explain some of their dedication to another arm. At all events the Germans claim special advantages for the lance. They say it has a far greater moral effect than any other form of the "arme blanche" (white arm) both objectively and subjectively when borne by a line of charging horsemen; that it adds greatly to the impact efficiency of shock tactics; that it is invaluable when riding down broken, opposing cavalry; easier to use against crouching or prone men on

foot, and that it produces particularly dangerous wounds. As a famous swordsman of Marlborough's time said, apropos of both lance and sword, "One point is as deadly as forty cuts." A sword cut rarely, but a well delivered thrust with sword or lance always, throws a man off his horse.

The two chief objections to the lance are that it hinders the mobility of dismounted action and is less useful than the sabre in a mêlée. And indeed in most men's hands a pike nine or ten feet long would seem a cumbrous thing at close quarters. Nevertheless, many instances to the contrary are on record. At Königgratz the lancers of the Eleventh Uhlan Regiment proved superior to Austrian sabres in a general mix-up, and the famous charge of the French Guard Lancers at Mars-la-Tours inflicted a 27 per cent. loss against Prussian cavalry armed in that fight with the sabre.

There must have been an extraordinary amount of cavalry engagement in the withdrawal of Sir John French's army from Mons to Noyon when General Allenby and General Sordet with their combined forces held the Germans in check long enough to save the Allies' left wing. When the true detailed account of all that charging and counter-charging comes to be written there will be plenty of data for the last word on cavalry arms, data which it is impossible now to obtain from the published accounts.

The use of the carbine brings up the moot point of the value of dismounted action for cavalry which is a subject on which opinions are as irreconcilable as are politics in a Latin-American

republic. Universal adoption of the carbine in all countries is sufficient indication of its value but, as the firearm is seldom or never used from the back of a horse, its possession imports into cavalry tactics very difficult decisions as between shock action mounted and fire action dismounted. Naturally one would be appropriate where the other would not, choice depending on character of terrain and particular results to be achieved. But the strong advocates of dismounted action are apt to turn the cavalry into mounted infantry regarding a horse chiefly as a very mobile means of transportation.

Against these riflemen the hard riding school —and they are the real cavalrymen—maintain that a trooper's chief asset is not his carbine, his lance or his sabre, but his horse and that his chief role is hard riding. Unquestionably troops which are led to rely on fire action become much less intrepid horsemen, their instinct when in difficulties being to dismount and take cover. In the valley of the Shenandoah in 1864 the Confederate squadrons were armed only with rifles whereas the Federals under Sheridan were trained both to shoot and charge. The result was significant. The Southerners, though better natural horsemen, were beaten at every turn, so that their commander had at last to report that his mounted infantry were absolutely useless against the Union cavalry. "In Germany," writes a British military critic, "it is held that mounted infantry cannot hold the field against a highly trained cavalry, for sooner or later they would be caught when in the saddle and then, before

they had time to dismount and fire, it would be all over with them."

Judging by the present war the time for shock action has not yet passed any more than it had in Von Bredow's time. Anyone who has tried it knows the extreme difficulty of hitting a galloping horseman charging directly head on in open order as always against infantry or artillery. Another thing must also be borne in mind. The very severity of fire in modern actions means that cavalry will repeatedly find broken infantry or batteries to rush under the protection of supporting artillery and infantry.

Varying Cavalry Organizations

When comparing the organization and equipment of the cavalry regiments of the five great nations engaged in this war and the composition of their several divisions, in general, it must be understood that cavalry is employed in two distinct capabilities: either independently in the form of cavalry divisions attached to armies or as divisional cavalry, *i.e.* small auxiliary bodies of horse, forming with artillery and infantry a regular division of an Army Corps.

The average European cavalry division contains from 3000 to 5000 troopers, and from 5000 to 10,000 men all told, for it must be remembered that such a unit includes as subordinate detachments batteries of horse artillery, signal and pioneer corps, and sometimes cyclist companies. It is, in fact, a small galloping army in itself, like a fast battle-cruiser at sea, capable of tackling anything of its own strength and of out-manœuvring

the heavier ordnance and numbers it cannot hopefully engage. Divisional cavalry, on the other hand, rarely operates independently of the particular infantry division to which it is attached.

Up to the outbreak of the present war modern German cavalry, with the exception of the Guards Division at Potsdam and Berlin, was organised only in brigades. But the progress of the war already shows that the German plans contemplated the mobilization of many of their 102 mounted regiments into flying divisions. Only one squadron is now assigned as divisional cavalry to each infantry division with special detachments of "Meldereiter" for orderly work, messenger service and mounted picket duty. In this matter of organizing their mounted troops, as in the range and power of their field artillery, there was much which, in the time of preparation, the Germans ably concealed from their adversaries.

France had at the outbreak of war ninety-one regiments, including the ten regiments of African cavalry. But, unlike Germany, of her mounted forces only thirty-seven regiments are, or were in July, organized into independent divisions. The war caught the French War Office just beginning to consider plans for a rearrangement, some of the divisional brigades having already been assembled in the early summer, probably with a shrewd premonition of war in the air, for independent exercises together.

Austria-Hungary has a three-fold cavalry system with forty-two line regiments—having the extraordinary number of six squadrons in each—supplemented by the Austrian Landwehr of six

Uhlan regiments and a Hungarian Landwehr of ten regiments of hussars or, as the Hungarians call them, "Honved."

Russia has at its disposal an almost fabulous amount of cavalry if one counts in all the "sotnias" (half regiments) of Cossacks which now in time of war are available. Luckily for Germany and Austria "Cossack" is no longer the same terror-bringing word it was before the Russo-Japanese War for in that losing conflict the supposedly irresistible Rough Riders of Asia failed to make any impression on the armies of Nippon, burdened as they were with their own awkward squadrons of almost seasick horsemen.

As a nucleus of his European mounted force the Tsar of Russia has eighty-three regiments of the line. But reckoning in the Orenburg, Kuban, Astrakan, and Trans-Baikalian Cossacks, he can marshal something like 1800 "sotnias" of men on horseback. Ghengiz Khan had not so many when he rode out of Asia in the twelfth century into Muscovy and hung like a black cloud over Europe.

Just how many mounted troops Sir John French has with him at this writing in France to harry Von Kluck's weary right wing cannot be accurately determined now. Whatever they may be in quantity, they have proved their quality.

You can fashion a fairly adequate infantry brigade or a field battery in a few months but you cannot make a useful squadron of cavalry in less than three years. As General Von Bernhardi

looking forward to this war, wrote five years ago, "A few days' training at a pinch will turn out an infantry soldier or gunner whose presence need not necessarily be either dangerous or even detrimental to the efficiency of his company or battery. An unbroken horse or a bad rider may create confusion in the ranks of the steadiest squadron." In this greatest of all wars the sacrifice of cavalry will be proportionately great. And such losses can never during the course of the war be made good.

C. M.

THE NERVES OF AN ARMY

HOW THE COMMANDER-IN-CHIEF SEES AND CONTROLS A HUNDRED-MILE BATTLE LINE

In comparison with other arms, it may be said that while the cavalry, artillery, and infantry, are the bones, sinews, and muscles of the body militant, the Signal Corps is its nervous system.

The harmonious action of all parts of the military machine depends primarily on the quick and precise delivery of information and orders, and it is upon lines of information that a commanding general depends to carry this information from the units of his force, and to return his orders to them. These lines are the means by which military information is transmitted, whether by wire telegraphy or telephony, radio-telegraphy, visual signals, messengers, or aeronautical craft.

Modern war involves the employment of huge armies distributed over an extensive terrain. With long-range and rapid-fire weapons has come a necessary dispersion of troops, and the consequent extension of the lines has threatened the efficiency of command by the general, and made increasingly difficult that unity of action so necessary to the successful employment of his forces. The adoption of neutral-coloured uniforms and the concealment

afforded by modern means of entrenching make still more difficult the delivery of orders by staff officers and messengers.

The apparent emptiness of the modern battle-field has been frequently remarked by observers in recent manœuvres and wars. Under present conditions in warfare, it may be said therefore that the speedy transmission of information, a prompt decision on its receipt, and celerity of movement are more than ever necessary. The space and time factors have greatly increased in relative importance. It devolves particularly on the Signal Corps to provide for this speedy transmission, and this is accomplished by the use of electric communication in the field.

The telegraph and telephone have become so much a part of our daily life in business and personal relations, that we scarcely realise our reliance upon the service rendered by the elaborate system of wires, apparatus, and well-trained personnel. To re-establish as far as possible such service under field conditions is one of the objects of the Signal Corps. It is obvious that, under such conditions, an entirely new line of equipment is required, and that men must be specially trained to use it.

In providing proper organization and supplies for military lines of information, the work to be performed may be considered, according to a "Scientific American" authority, as divided into three classes. First the maintenance and operation of such lines from the capital of the nation to the headquarters of the Army in the field; second, the construction, maintenance and operation of radio-telegraph stations and semi-permanent telephone

and telegraph lines from the headquarters of the Army in the field forward to the various divisions at the front, also the provision of the necessary camp telephone and telegraph lines within the Army; third, the establishment of the temporary lines in the combat zone included within the active field operations of the divisions, consisting largely of insulated wires laid on the ground and the radio-telegraphic and visual signal communication for tactical purposes.

In the second class, viz. communication from field headquarters to the front, the work performed is in territory where recent military operations make it necessary to organize and equip for conditions quite unlike those for electrical communication in peace times. The wire-lines must, in general, be hastily built with light wire supported on temporary small poles, and the radio-apparatus must be of a portable variety.

Telegraph apparatus employed on high resistance and poorly insulated wire is of the special type requiring only a few dry cells for operating over long and difficult lines. All the equipment of light poles, wire, and instruments has to be divided up into proper proportions for the different requirements, and special wagons have to be provided to ensure its transportation in accompanying the field army or divisional headquarters. The officers and men designated for this work are organized into telegraph companies and telegraph battalions. The sections of these companies are each equipped and drilled to instal a well-defined part of the system.

The telegraph section can establish and operate a certain amount of line with the stations thereon.

The telephone section is equipped to put in a camp central station with the wire and telephones for a large camp. The officers and men of the telegraph battalions must be well trained, not only in their technical but also in the soldierly duties pertaining to active field service.

A class of duties falls to the lot of the Intelligence Service troops serving in the zone in front of the divisions, that requires an entirely special equipment. To them is assigned the task of maintaining lines of information during action, hence these have been called "tactical" or "combat" lines. The wire lines consist of insulated wire laid on the ground, for it is only such lines that can be laid and used to follow the rapidly changing phases of the conflict.

As each infantry brigade and the artillery goes into action, it is followed by a reel cart laying wire from division headquarters. The strong flexible wire employed is an insulated one of stranded steel and copper, and can be laid from the cart at a gallop, and almost as quickly reeled upon the drum by means of a chain and sprocket gear. For emergency use and over short distances, a much lighter wire can be laid from a hand reel. These wires being of high resistance, and frequently leaky, a special instrument known as the buzzer has been developed for operating over them.

Will Telephone over Broken Wires

This remarkable instrument contains in a metal lined leather case a small dry battery, induction coil and interrupter, key, telephone receiver, and telephone transmitter. When the key is pressed

the interrupter operates, and sends out from the coil an alternating current, which traversing the line and distant telephone receiver gives out a sharp note. The intermittent current produced by the sending key becomes the dots and dashes of the Morse alphabet. By pressing a button on the side of the transmitter, the instrument is at once transformed into a field telephone.

Owing to the sensitiveness of the telephone receiver, the intense buzzing sounds sent out as Morse telegraph signals are audible over an incredibly bad line. For example, it has been worked successfully over twenty miles of bare wire laid on the ground in rainy weather. It can be made to work over a wire which has been broken, and the ends left lying fifty feet apart on damp ground. The whole apparatus is reduced to practically the size of a field-glass case, and weighs about five pounds, rendering it readily portable by means of a strap over the shoulder.

In addition to the need for communicating from division headquarters to the infantry and artillery brigades, the divisional cavalry requires means for reporting back what its patrols and scouting parties ascertain. It would be inadvisable to hamper the divisional cavalry's movements with wire connections of any kind, so the light field ratio pack sets have been devised to accompany the swiftly moving cavalry.

How Signal Troops are equipped

In addition, near division headquarters, a more powerful radio set in a special wagon is always ready to set up and communicate with the cavalry

pack set or others. The radio pack set, with generator, sectional mast, aerial wires, or antenna attachment, tent and accessories, makes moderate loads for and is carried on three animals. With easily manipulated strap attachments, the set can be made ready for use by the mounted section in a minute from the time a halt is ordered. The wagon type of radio apparatus derives its power from a gasolene engine, the alternator develops about two and one half kilowatts, and a sectional mast eighty feet high is employed. This can be put up and the set operated in fifteen minutes. The range under ordinary conditions is about one hundred and fifty miles.

In addition to electrical equipment, the Signal troops serving with the division are supplied with signal flags, heliographs, and acetylene lanterns for day or night visual signalling. The larger signal flags are used to transmit messages by the "wig-wag" system. The groups of right-left-front signals correspond to letters, and with a powerful glass may be read at distances of ten miles. The small semaphore flags are used in the hands in pairs, and as the combinations in positions are simultaneous signalling is performed at considerable speed, but, owing to the small-sized flags, only over comparatively short distances.

The heliograph consists of either one or two small mirrors mounted on a strong tripod, and by means of screw adjustments may reflect the light of the sun to the distant station in any direction desired. The reflected rays are controlled by a shutter made up of movable blades, operated with a key like a telegraph key and mounted on the tripod. The

long and short sun flashes, which may thus be sent, correspond to the dashes and dots of the Morse code. With a four-inch square mirror signals have been sent eighty miles. The disadvantage of the heliograph is that it depends upon sunlight being available at both stations.

The acetylene lantern is, in effect, a small acetylene searchlight like those used on automobiles The lantern is mounted on a heliograph tripod. By means of a tiny pilot flame, the main acetylene jet is lighted when a key is depressed. The flame is extinguished when the key is raised. Thus flash signals may be transmitted similar to those sent by the heliograph. The range of this small lantern is about twenty miles on a favourable night.

HOW THE MOTOR AFFECTS WAR

BY MAKING POSSIBLE THE QUICK MOVEMENT OF LARGE BODIES OF TROOPS AND OF HEAVY ARTILLERY, AND BY IMPROVING THE RANGE AND EFFECTIVENESS OF THE COMMISSARIAT : THE ENGLISH, FRENCH AND GERMAN MOTOR EQUIPMENT AND ITS PERFORMANCE IN THE PRESENT CONFLICT

A RED CROSS man recently described a significant incident of one of the battles on the Russian-German frontier, in the following words :

"I was walking beside one of our carts. We could hear heavy artillery fire as we went along, when shouts from our people behind warned us to get off the road. We pulled on to the grass, and there came thundering past, bumping from one rough place to another on the poor road and going at a sickening pace, a string of huge lorries (auto-buses) crowded with infantrymen. They looked like vehicles of the army establishment, all apparently alike in size and pattern, and each carried about thirty men packed like cigars in a box.

"The lorries were travelling like no motor wagon that I ever saw—certainly at not less than forty miles an hour—and they seemed endless. I didn't count them, but there were not

less than a hundred, and perhaps a good many more.

"That was Rennenkampf reinforcing his threatened flank."

It is an interesting picture—a dashing Russian general sending two or three thousand reinforcements to a weak spot in his line by motor.

During and after the battle of the Marne thousands of French soldiers went to the front from Paris in a long line of taxi-cabs. Earlier in the war whole fleets of omnibuses from Piccadilly and the Strand, flaring with British advertisements, rolled to the front bearing English infantrymen.

In Belgium a certain lieutenant caused havoc among the advance patrols of Uhlans by sheathing a car in armour and mounting a machine-gun which he used with deadly effect. The regular method of transit for British officers from the Channel ports to the firing-line is by motor-car, the trip taking from four to five hours. The leading Continental and British racing drivers are acting as pilots for the commanding officers. Boillot, winner of the Grand Prix a year ago, is serving as chauffeur for General Joffre.

There are French motors carrying huge search-lights mounted on stands with small wheels. These stands may be removed from the body and pushed to the desired position, attached by current wires to the wagons, from which they draw the necessary electricity.

Motor-cars are used by the several armies as tenders for aircraft. Special trucks are fitted as repair shops both for aeroplanes and for the other

motor equipment. They are able to carry disabled flying machines from the field. They transport machines, in folded form, to the desired base of operations. The French have a whole fleet of trucks for this purpose. This co-operative type of service between motors for land and air has been carried to a high point of development by the Russian War Department. Three aeroplane-carrying trucks and a motor-driven repair shop form, in the Russian army, an independent unit known as an *escadrille.* Almost enough parts and materials are carried to rebuild a complete aeroplane in the field.

Most of the ambulances are motor driven—some being really field hospitals in miniature, containing operating tables and even X-ray apparatus; others are purely ambulances, the largest of which can carry fourteen wounded men comfortably.

The field wireless station, are mounted on automobile chassis. But these special uses, spectacular and efficient as they are, are second in importance to the automobile services in transporting food for men and guns and in some cases the guns themselves. The great siege guns of the Germans which have played such a prominent part in the fighting are drawn by special motor tractors which do the work of forty horses whenever the nature of the country permits.

Lighter guns, also, in both German and French services, are drawn by motor tractors which pull along the caissons as well. The military critics have pointed out, indeed, that the German army could not have shown its marvellous mobility in

the march on the Seine or in the subsequent retirement had it not been for its complete motorization.

England has been somewhat behind the other combatants in the hauling of guns by motor-car, but some tests made just before the outbreak of hostilities were so successful that it is safe to assume that the same thing has been tried by the British expeditionary force on the Continent. In these tests a record-breaking dash was made by the West Riding Territorial Battery of Royal Horse Artillery from Sheffield to the coast. The guns were hitched to powerful touring cars and were thus drawn in nine and a half hours a distance which it would have required from three to four days to make with horses. The guns were drawn ninety-nine miles on eight gallons of gasolene. There was not a single breakdown on the road, and the brakes on the cars proved entirely sufficient to hold the guns and limbers on the hills.

The Motor War Scythe

The Germans, in addition to the mammoth gun tractors, have developed another type of effective and rather novel motor apparatus—a cross between a motor-truck and a steam-roller, weighing five tons or more and fitted in front with broad roller wheels. It will tear a way through barbed-wire entanglements, brushwood, and *chevaux-de-frise*. On the hubs of the front wheels long knives are set at an angle like scythes, somewhat in the manner of the chariot wheels of the ancients, though of course their object is to clear obstructions, not to cut the enemy.

Certainly the amazing characteristic of the campaign in France has been the speed displayed by both sides. It is here that the motor-car shows its great superiority. It is the handling of the transportation problem for so vast an army as the Germans have put in the field that has amazed the military experts.

Enormous Savings in Supply Trains

Under the old system, to supply a division composed of 20,000 men, which is the chief fighting unit of the United States army, requires 662 four-mule wagons to carry forage, rations, and ammunition. These wagons are capable of carrying five days' reserve rations and grain and a small ammunition reserve. Even with all these wagons a division can keep supplied only from a depot about two days' march in the rear—a day's march being determined by the distance which can be covered by the transportation wagons, being twelve miles under ideal conditions of climate and road. In addition to the wagons already mentioned, 269 of other types of vehicles, including ambulances, caissons, field wireless, and wagons for sappers' materials and pontoons are required. This makes a total of 961 vehicles with approximately 4000 animals for each 20,000 men. But all this equipment will not give the fighting force a radius of more than twenty-four miles from its base, should that base be upon a railway; if it be not on a railway an enormous number of additional wagons is required.

One vital consideration is the amount of space occupied on the march by the transportation

column and, in consequence, the amount of protection which must be given it. Each of the vehicles at present assigned to a division of the United States army occupies about twenty yards of roadway. In other words, if the 961 wagons were in column on a single road they would stretch eleven miles! The difficulty of guarding such a column may be easily imagined. In addition, the average load of these vehicles is only about 3000 pounds apiece.

According to the American War Department most of these disadvantages of horse or mule equipment would be abolished or minimized by the use of motor vehicles. A truck that is capable of carrying 4000 pounds is by no means a large one, yet this increased capacity alone would mean a reduction by 25 per cent. in the number of wagons needed, or from 961 to 720. Furthermore, a saving of road space of at least 25 per cent. would follow the use of motor-trucks, and this saving, with the smaller number of vehicles required because of greater load capacity, would reduce the length of the column of march from eleven miles to less than six miles.

Lastly, but probably most important of all, the mobility of the fighting force would no longer be dependent on that of the wagon train, for at an average speed of ten miles an hour the day's march of the motor wagons would far exceed any possible day's march of the troops. This liberation of the troops would mean that the base of supplies could be much farther in the rear than with animal transport—hence probably in a far safer position—and supplies could be

brought up from an enormously greater range of country.

Germany realized clearly the value of efficient motor transportation long before the outbreak of the present combat. Calculations were made by the General Staff which showed that to supply an army consisting of four army corps and two cavalry divisions at a distance of eighty miles from its base, 4050 wagons, 4900 men, and 8100 horses would be required under the old method. With motor-trucks, however, the same force under like circumstances could be supplied by 550 trucks and 2200 men. For the ability to put such motor trains in the field in time of need, Germany was ready to pay handsomely. The subsidy system in force just before war was declared was, therefore, a generous one. Trucks of the specified types, ranging in weight from two to five and a half tons on the rear axle, were made attractive to the individual owner by an original payment made to him of £85 by the Government upon his purchase of the vehicle followed by four annual payments of £40. If a trailer was provided with the truck—a method of which the Germans are fond—the first payment was £140 and the annual payments £55. Of course the arrangement contemplated the immediate turning over of the equipment to the army for war purposes, the participation in manœuvres, and inspection as to fitness several times each year.

In France a truck, in order to be subsidized, must be entirely of French manufacture, must be in commercial use in France, and must conform to the requirements of the military authorities.

The bounty to the owner is on a sliding scale, with a total which varies according to the type of machine from £200 to £360.

The German army has also used the subsidy plan for passenger automobiles. The members of an organization known as the Volunteer Automobile Corps pledged themselves to put their cars, after the latter had received the approval of the army experts, in the field in war.

R. M. C.

"ATROCITIES" IN WAR

THE COMPLAINTS OF THE FIGHTING NATIONS THAT THEIR ENEMIES ARE USING BARBAROUS METHODS : THE COMPARATIVELY MERCIFUL DUM-DUM BULLET : PRECEDENTS FOR BURNING CITIES AND RAVAGING THE COUNTRY-SIDE : THE UNPROGRESSIVE ART OF MILITARY LYING

[May I give a word of caution to my countrymen against the unsportsmanlike practice of abusing one's enemies? Let us avoid what Kipling during the Boer War described as "killing Kruger with your mouth." Let us rather devote all our energies to defeating our foemen by the superior fighting of adequate numbers of British soldiers in the open field.

When we read the charges against the German troops let us remember that gross charges absolutely untrue were brought against our own brave soldiers fighting in South Africa; but whether the charges are true or not let us keep our own hands clean and let us fight against the Germans in such a way as to earn their liking as well as their respect.—LORD ROBERTS, in *The Hibbert Journal*.]

LYING has ever been as much a part of warfare as blows and wounds. War being a reversion to savagery, it is to be expected that veracity should be submerged along with other virtues. Under these circumstances allegations from combatants regarding the conduct of their foes should be taken, not with a grain of salt, but with many grains.

Belief should be all the more grudging because under conditions imposed by war it is impossible to obtain evidence that would be accepted in any court either confirming or refuting tales of atrocities.

Though other branches of military art and science have made noteworthy progress in the last half-century, military prevarication has hardly advanced at all. The same old tales that served in wars of a former generation are made to do duty to-day.

In formally inviting the attention of the United States Government to the charge that Germany's foes were using dum-dum bullets, the Kaiser but followed the precedent set by Bismarck, who, in a dispatch from Versailles, dated January 9, 1871, recited the familiar formula about expanding bullets being found in the pockets of a Frenchman though neither the name "dum-dum" nor the particular form of expanding bullet to which it is applied had then been invented. Bismarck said he would forward the horrid things to the Foreign Office to be submitted to the representatives of the Powers.

In the South African War the Boers and their sympathizers accused the British, and the British accused the Boers, of using dum-dum bullets. In the Russian-Japanese War each side formally charged the other with using dum-dum bullets. In the Balkan War it was the same. It is scarcely an exaggeration to say that the filing of the dum-dum charge has come to be regarded as a solemn rite without which no war could be regarded as properly launched.

It is true that all nations have used explosive or

dum-dum bullets, or both, in war. The Russians used explosive bullets, invented by an Englishman ninety-two years ago, in the Crimean War. They were adopted by England in 1862. Prussia, Bavaria, Austria, Switzerland, and other countries all used explosive bullets. Early in the American Civil War 33,350 explosive bullets were issued to Federal troops. The Confederates captured 10,000 of them and fired them at their former owners. The German observer with the Confederates saw explosive bullets used in action near Fredericksburg and pronounced them ineffective.

This may, or may not, have been the controlling reason why no nation has used explosive bullets since 1868. Nevertheless, it was Russia, popularly supposed to be the most benighted of nations, that first proposed to abolish this sort of ammunition, not because it was ineffective, but on the ground that it was needlessly cruel.

Having abandoned explosive bullets, and finding the ordinary bullet then used in the Lee-Enfield rifle incapable of stopping the rushes of Afridis, Fuzzy-Wuzzies, Dervishes, and other savages, England resorted to "dum-dum," or expanding bullets, so-called from Dum-Dum, a town four and a half miles north-east of Calcutta, containing an arsenal where these missiles were first made. This produced the same sort of effect as the explosive bullet, but by a different method. It consisted of a steel or nickel jacket with a lead core. At the point was a hole in the jacket about the size of a pin, or a slight notch, so that, when the bullet struck, the jacket would open like the leaves of a flower and the soft lead

core would mushroom, tearing a hideous wound in the victim.

At the first Hague Conference in 1899 all nations but the two supposed to be farthest advanced in humanity, England and the United States, agreed not to use dum-dum bullets any more. At the second conference in 1907 these two nations also signed the agreement.

But since the first Hague Conference no nation has used dum-dum bullets for a compelling reason that has nothing to do with The Hague or with considerations of humanity. Experience has taught that when a modern high-powered rifle, such as is used in all armies to-day, is hot and dirty, conditions common in battle, the dum-dum bullet is liable to "strip"; that is, the leaden core is apt to squirt out, leaving the jacket in the barrel, so that when the next shot is fired the gun blows back, or bursts. The owner may be killed, and his weapon is sure to be rendered useless.

Although England was accused of using dum-dum bullets in the Boer War, the fact is that at the opening of hostilities the War Office hastily recalled all ammunition of that character for those reasons. It was a very serious step to take, for nearly half the stock of ammunition on hand was of the dum-dum variety. But the Government dared not risk such uncertain ammunition in such an important enterprise.

The shallow hypocrisy of the conventional cant about the use of dum-dum bullets may be appreciated when it is remembered that though the bullet used in modern high-powered rifles often

makes a clean perforated wound about the size of a lead-pencil which heals quickly, it all too frequently " tumbles," or assumes " spinning top," " hour-glass," or " pirouetting " motions with the result that the wound it inflicts is quite as ghastly as any that a dum-dum could produce. Aside from all this a bullet propelled by the modern rifle strikes with such terrific force that even when it enters the body without erratic motions it produces a series of molecular shocks which radiate cone-wise from the point of impact to the molecules on the opposite side. Though it may enter by a small hole the bullet may, and often does, completely disintegrate organs through which it passes, and the point of exit may be a ragged wound as large as a saucer.

Shrapnel Worse than Dum-Dums

To throw the cant about the " inhumanity " of dum-dum bullets into still stronger relief, bear in mind that the same enlightened international code which strains at the dum-dum gnat swallows the proverbial camel by sanctioning the use of shell and shrapnel, which never produce a " humane " wound, but only the most ghastly mutilations. The following description by Mr. Ellis Ashmead Bartlett of the effects of shell fire at the battle of 203 Metre Hill, during the siege of Port Arthur in 1904, makes the point sufficiently clear.

" There were practically no bodies intact; the hillside was carpeted with odd limbs, skulls, pieces of flesh, shapeless trunks of what had once been human beings, intermingled with pieces of shells, broken rifles, twisted bayonets, grenades, and

masses of rock loosened from the surface by the explosions."

No formula of words seems to cover the dum-dum subject more satisfactorily than the following from a letter from General Sherman to the Confederate General Hood:

"If we must be enemies let us be men and fight it out, as we propose to do, and not deal in such hypocritical appeals to God and humanity."

An important point to be borne in mind is that what is really part and parcel of warfare is denounced as abuse and atrocity. Sherman never coined the aphorism so frequently attributed to him, though he did his best to make war fit his alleged definition. What he did say was, "War is cruelty; and you cannot refine it." Napier said, "War is hellish work." Both understated the fact.

Massacre of Non-Combatants "Legitimate"

For example, the Germans were within their rights in destroying Louvain and massacring its male inhabitants if the latter fired upon German soldiers, as the latter allege. The Hague Regulations, so often paraded as the loftiest expression of the world's awakened conscience, sanctions the course of the Germans, always assuming that their contention is correct. And as all the competent witnesses for the Belgians are dead, the Germans clearly have the best of the argument.

In the tragedy of Louvain the history of Bazeilles, which sent a thrill of horror through the civilized world forty-four years ago, repeated itself. Bazeilles was a French village south of Sedan, on the road

to Montmédy. During the fighting in the vicinity the inhabitants of the village took an active part, according to German official history, sparing neither wounded nor stretcher-bearers. The official history piles on the horrors, alleging that the villagers poured hot oil over the wounded before carrying them into burning houses to be roasted alive. It does seem supererogatory to go to all the trouble of heating oil to pour on a victim for whom a fiery furnace is already waiting, and in the turmoil and excitement of battle, too; but that is what the Germans say. The French say their foes bayoneted old men and women and threw infants into burning buildings.

Again there were no competent witnesses for the defence when the incident was closed; but there seems to be no doubt that the villagers resisted the invaders and that the latter killed all they found with arms in their hands with some others for good measure, and burned the place.

When the Germans captured Gisors in October 1870, they refused to treat the franc-tireurs, the French term for guerillas, as prisoners of war, but shot five of them on the spot without trial. In the course of the war great numbers of guerillas were shot after their capture by the Germans. One batch of twenty-five prisoners was shot at one time.

Under the law of nations, as defined by The Hague Conference and subscribed to by all civilized peoples, a citizen whose country has been invaded has no right to protect his property, his family, nor his life unless he belongs to a military organization duly constituted by his Government and wears

a uniform. In the latter case the invaders may lawfully kill him in battle if they can shoot straight enough; but if he fights without uniform they may legally kill him after he has been made prisoner and is helpless, and without trial, too; that is, the killing is lawful and proper if the executioners are civilized Christians; but if they are savages, it is wrong. Average folk, equipped with nothing but ordinary standards of morality for their guidance, may not be able to grasp the distinction, but there is a great difference; all the authorities on international law say so. To quote an English authority on the Bazeilles incident:

"Extreme as the punishment was, the inhabitants had undoubtedly broken the laws of war in joining in the street fighting, and the Bavarians had a clear right to deal summarily with those taken red-handed in action."

It must not be supposed that Bazeilles and Louvain are isolated instances. History affords ample evidence of the invader's right to punish popular resistance, and of the liberal exercise of that right. Napoleon gave short shrift to citizens who ventured to dispute his progress by force of arms. In the Russian-Turkish War in 1877, when the Russians captured Eski-Zagra, shots were fired on them from certain houses. Thereupon General Gourko ordered that the inhabitants of all such houses should be hanged at their doors.

The Destruction of Property

In the South African War the British burned all houses from which shots were fired at the troops. The snipers, when caught, were imprisoned or

deported, but in no instance was the death penalty inflicted. Whenever a railway was damaged Lord Roberts destroyed every house within ten miles of the scene.

This was in accordance with precedents created in the American Civil War. General George H. Thomas, one of the kindest and gentlest of commanders, was for a time dependent on a single line of supplies, a railway over the Cumberland Mountains. Guerillas, claiming to be innocent non-combatants, kept burning bridges and choking tunnels with logs and rocks until Thomas gave notice that the next time a tunnel was obstructed he would burn every house within five miles. There was no more trouble.

It is a great help in appraising the acts of war at their true value to remember that everything depends on whose ox is gored. What to the victims, and perhaps, also, to the neutral observer, may seem barbarous vandalism is to the perpetrators a proper and necessary act sanctioned by international law.

The instructions prepared for the Federal forces in the American Civil War declared that "Military necessity . . . allows of all destruction of property," provided it be "indispensable for securing the ends of war." Article 23 (g) of The Hague Regulations reaches the same conclusion by different verbiage: "The destruction and seizure of any property is illegal, unless imperatively demanded by the necessities of war."

As the commander in the field is the sole judge of what is demanded by any given set of circumstances, it may readily be imagined that Military

Necessity covers more sins than Charity ever does.

An incident in the Franco-Prussian War, from which conflict most modern laws of war date, shows to what lengths military necessity can be justified. The Germans, fearing that French gunboats might come up the Seine, seized some British colliers and sank them in the river to form an obstruction, with the British flag still flying, and scarcely allowing the crews time to escape. Bismarck pleaded that the act was necessary and England did not demur, but accepted the indemnity which Germany proffered.

Cash Levies in War

Most, if not all, the accusations of atrocities heard in the progress of the European conflict were brought against the United States in the Civil War; and many of these charges had about the same proportionate basis of fact. In levying contributions on captured Belgian and French towns the Germans did no more than the Confederates attempted to do by General Early's order at Chambersburg, Pa. When a contribution of £40,000 in gold was not forthcoming on demand the Confederates burned the town without waiting for the removal of women and children or the sick.

By this process of levying contributions on captured towns, a custom much in favour in buccaneering days, the Germans did very well in the Franco-Prussian War. In addition to £200,000,000 and two provinces exacted from the National Government of France, they also collected £24,600,000 from captured towns and

provinces in the form of contributions, taxes, and requisitions. They also established a precedent which has not been effectively questioned, which has proved profitable in the present instance.

Federal forces in the American Civil War made no attempt to levy contributions on Southern towns, for that contest was not waged for profit; but they were ruthless in the destruction of property. The reason for this policy was clearly stated by Sheridan:

" Death is popularly considered to be the maximum of punishment in war," said he, " but it is not; reduction to poverty brings prayers for peace more surely and more quickly than does the destruction of human life, as the selfishness of man has demonstrated in more than one great conflict."

Grant, Sherman, Sheridan, and Halleck heartily agreed on this point. In sending Sheridan on a raid in the Shenandoah Valley, Grant ordered him to " Do all the damage to railways and crops that you can. Carry off stock of all descriptions and Negroes, so as to prevent further planting. If the war is to last another year we want the Shenandoah Valley to remain a barren waste." An irreverent private paraphrased these instructions by saying, " The rebellion must be put down if it takes the Confederacy's last chicken."

Sheridan carried out his instructions so well that it was said that " a crow flying across the Shenandoah Valley would have to carry its own rations."

Before starting on his famous march to the sea Sherman ordered all the inhabitants of Atlanta to leave, offering them transportation to the

Confederate lines or to any point in the North they wished to go. This brought a letter from General Hood in which he said Sherman's order "Transcends in studied and ingenious cruelty all acts ever before brought to my attention in the dark history of war." Sherman retorted by telling the Confederate leader to "talk thus to the marines but not to me;" and reminding him that he had defended Atlanta on lines so close that even Federal musket shots that overshot the mark went into houses occupied by women and children, and other things to show that "studied and ingenious cruelty" was not all on his side. Hood gave a carefully edited version of the correspondence to the newspapers to "fire the Southern heart," thus setting an example that has been faithfully followed by governmental press bureaux in the present conflict.

Sherman's final act was to raze all buildings in Atlanta that had been used by rebel forces and set fire to the ruins. All the business portion of the city was destroyed, though dwellings were spared. In his march through Georgia and the Carolinas he devastated the country, destroying mills, railways, granaries, crops, seizing horses, cattle, sheep, hogs, turkeys, wagons, and everything else that could be eaten or otherwise used by the enemy. As a direct result of this raid Lee's men lived for months on less than half-rations. This wholesale destruction did a great deal to hasten the end of the war.

Burning of Towns in War

Columbia, S.C., was burned immediately after it fell into Sherman's hands, but the fire was started by Wade Hampton when he evacuated the place. The Federals tried to put out the fire but could not on account of a high wind. Richmond was also burned by fire started in some tobacco warehouses by the Confederates when they left. Jackson, Miss., though, was deliberately burned by Sherman by Grant's direct orders as a "railroad centre and manufacturing city of military supplies." When the Memphis *Bulletin* complained of the waste committed by the Federals Sherman replied:

"Yes, it is waste; but it is also war, for war is waste—waste of lives and waste of property. A command must commit waste in many ways—it must trample crops, take materials to construct fortifications, cut down fences, clear the ground of anything that would obstruct its fire or give cover to the enemy. Such damage is chargeable, not to the troops who cause it, but to the very nature of war, for, generally, war is destruction and nothing else."

The Federal forces were outdone in the work of destruction by the British in South Africa. In the six months ending with January 1901, 634 Boer farmhouses were burned. This aroused public indignation everywhere and brought recruits to the Boer forces which were thus strengthened so that they regained territory on every hand. Instead of changing their policy Lord Kitchener instructed columns to clear the country of supplies of horses, cattle, crops, and vehicles, burn all that

the army could not use and destroy mills and bakeries. The eastern Transvaal, once a land of plenty, was turned into a blackened desert. Not a beast, not a field of standing corn, not a native was left.

Some women and children were left on the veldt without food or shelter to starve unless rescued by the Boers; but more than 100,000 of them were gathered in concentration camps, the conduct of which was severely criticized.

Concentration Camps

It will be remembered that "Butcher" Weyler's concentration methods in Cuba did much to rouse the storm of popular indignation in the United States which culminated in the war with Spain. It does seem a little odd, therefore, to find Americans in the Philippine insurrection doing the very thing for which they denounced Weyler. True, the Americans did not exactly establish concentration camps; instead they provided "zones of refuge," which is a much more euphonious term. Into these zones of refuge the inhabitants were "invited" and everything outside of them was destroyed. Results were prompt and decisive. In a few months order was restored and the inhabitants were able to return to their lands.

One of the popular myths about atrocities of war relates to the wholesale poisoning of the enemy. This tale has already seen service in the present conflict, Russians and Germans appearing alternately as poisoners and intended victims. The use of poisons is expressly prohibited by The Hague Regulations; but a much more effective

deterrent is the difficulty of wholesale poisoning by direct means.

At the beginning of the Boer War the English newspapers freely accused the Boers of robbing the gold milling plants in the Rand of cyanide with which to poison wells and streams used by British troops. Of course the Boers did nothing of the sort; but they did cut off Bloemfontein's water-supply, a step that is lawful and proper under The Hague Convention, thus forcing the British garrison to use water from tainted wells, which caused an epidemic of typhoid fever. Again the common mind may fail to grasp the delicate distinction between administering to an enemy a fatal and illegitimate dose of cyanide of potassium and giving him an equally lethal, but perfectly proper, dose of typhoid germs.

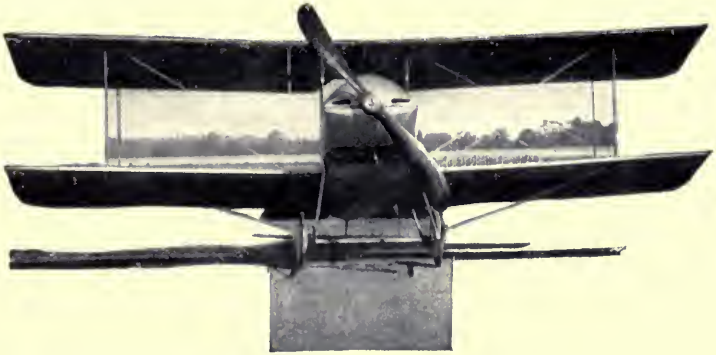
In retreating before Sherman's forces after the fall of Vicksburg, the Confederates under Johnston tried to poison their foes without resorting to illegal methods by driving cattle, horses, and sheep into the ponds from which the Federals would have to draw their water-supply and shooting them there. The plan failed because the Federals drew the carcasses out and used the water—and survived.

Death to Escaping Prisoners

The Hague Regulations insist upon the humane treatment of prisoners and have laid down the dictum that even cases of attempted escape should not be punished by death, but by some milder form of discipline. The German General Staff, however, entertains progressive views on this

point. Soon after the first Hague Convention a pamphlet issued by the General Staff argued that it was legitimate to shoot prisoners who attempted to escape, and also to shoot them on two grounds of policy; first, as an act of reprisal if the enemy had done the same thing or had been guilty of some other act of inhumanity—the provocation to be decided by the Germans, of course—and, second, when it is impossible to keep the prisoners without compromising the security or efficiency of their captors. This is as liberal an interpretation of the law as a Sioux chieftain could ask. If stories about the Germans compelling captive Belgians to work on fortifications for them are libels the Germans have no right to complain, in view of that pamphlet and of the further fact that the General Staff also maintains, in direct contradiction to The Hague Regulations, that they have a right to force non-combatants to work for them. In other words, they claim the ancient privilege of enslaving captives.

C. F. C.



A BRITISH ARMOURED BIPLANE

THE WAR IN THE AIR

HOW THE AEROPLANE-SCOUTS DIRECT ARTILLERY FIRE, AND HOW THEY FIGHT: DUELS IN THE AIR: AEROPLANES *versus* ZEPPELINS

"VICTORY," said Wellington, "belongs to the commander who makes the best guess as to what is happening on the other side of the hill."

The aeroplane changes the guess to a certainty. It tells a general what his enemy is doing not only behind the first hill but behind any number of hills. It gives information that would bring almost certain victory—if the other general were without similar information. The airscout is an absolute essential in modern warfare. The complete superiority in the air branch of the service would be worth many thousands of men to a modern army, for it would enable the commander to know the enemy's movements and therefore to make the most efficient use of his own men—and waste none where they were not needed.

The results of two months of war show that the aircraft, principally the aeroplanes, have given results beyond even the most enthusiastic expectation. Though the reports of spectacular happenings, such as dropping of bombs, occasional encounters of aeroplanes in the air, and aircraft

ramming each other show striking points of value, the most valuable accomplishment has been, as the eyes of the armies and navies, watching the movements of the enemy, thereby removing the element of surprise.

The war was only a few days old when the Belgian airscouts scored the first success, the results of which have influenced the entire campaign. There is evidence that Germany in her underestimation of the tenacity of Belgium did not make good use of her airscouts. It relied entirely on the overwhelming strength of her formidable army and did not consider it necessary to employ airscouts to find the vulnerable spots and offset the advantage gained by Belgium through its very judicial employment of the able Belgian airscouts. The Germans started in with a crushing preponderance of men, but played the game in accordance with plans made many years ago, with little consideration to the immediate moves of the enemy, while the Belgians with few men, but employing a score of efficient airscouts, moved as circumstances dictated. The result was a comparatively large loss of men and an inestimable loss of time on the part of the Germans.

Subsequently, however, the German airscouts were employed very extensively. Each day during the war has brought reports of exploits of German aviators. They have been reported as far as one hundred miles from their nearest base, have dropped bombs and manifestos on Paris and several other cities—rather venturesome undertakings considering that there were scores of French

A NON-RIGID FRENCH DIRIGIBLE STARTING ON A NIGHT CRUISE

This dirigible can carry 16 people and can cruise at a speed of 42 miles an hour for 20 hours without stopping. Seven dirigibles of this type, but larger and capable of a speed of 60 miles an hour, were delivered to the French Army just before the war. All these dirigibles have armoured carriages equipped for bomb dropping and guns for defence against aeroplane attacks

aeroplanes about that were reputed to have a speed of 120 miles an hour, twice the speed of the German machines. French aviators at the front have paid compliments to those hardy German aviators who circle unceasingly over the troops throughout engagements, continually watching the movements of the Allies.

At the beginning of the war the Royal British Flying Corps—the thirty-six aeroplanes, fully equipped, carrying fuel for from four to six hours—crossed the English Channel altogether without the slightest mishap, and reached their objective point at a mile-a-minute speed! The British Press Bureau has given out the following statement, about its work since:

"One of the features of the campaign on our side has been the success obtained by the Royal Flying Corps. In regard to the collection of information it is impossible either to award too much praise to our aviators for the way they have carried out their duties or to overestimate the value of the intelligence collected, more especially during the recent advance.

"That the services of our flying corps, which has really been on trial, are fully appreciated by our Allies is shown by the following message from General Joseph Joffre, the commander-in-chief of the French armies, received on September 9 by Field-Marshal Lord Kitchener:

"'Please express most particularly to Marshal French my thanks for the services rendered on every day by the English Flying Corps. The precision, exactitude, and regularity of the news brought in by its members are evidence of their

perfect organization and also of the perfect training of the pilots and the observers.'

"To give a rough idea of the amount of work carried out it is sufficient to mention that during a period of twenty days up to September 10 a daily average of more than nine reconnaissance flights of more than one hundred miles each has been maintained.

"The constant object of our aviators has been to effect an accurate location of the enemy's forces and, incidentally, since the operations cover so large an area, of our own units.

"The tactics that have been adopted for dealing with hostile aircraft are to attack them instantly with one or more British machines. This has been so far successful that in five cases German pilots or observers have been shot while in the air and their machines brought to ground. As a consequence the British Flying Corps has succeeded in establishing an individual ascendency which is as serviceable to us as it is damaging to the enemy.

"How far it is due to this cause it is not possible at present to ascertain definitely, but the fact remains that the enemy have become much less enterprising in their flights. Something in the direction of the mastery of the air already has been gained in pursuance of the principle that the main object of military aviators is the collection of information.

"Bomb-dropping has not been indulged in to any great extent. On one occasion a petrol bomb was successfully exploded in a German bivouac at night, while from a diary found on a dead German cavalry soldier it has been discovered

A VICKER ARMOURED AEROPLANE, USED BY THE BRITISH ARMY

It carries a Vicker machine gun for use against other aircraft. The flag with the Red Cross on it was used to identify the machine during experimental flights, as the British authorities had forbidden all flying except by order of the War Office

that a high explosive bomb, thrown at a cavalry column from one of our aeroplanes, struck an ammunition wagon, resulting in an explosion which killed fifteen of the enemy."

Airscouts may be thankful that it so happens that the altitude required to keep out of reach of rifle fire is not too high to allow clear observation of things below. The British War Office's instruction to airscouts is not to fly lower than 3000 feet when exposed to rifle fire, and to add another thousand feet when artillery is underneath. The French agree on these figures, and pilots are officially instructed to regard them. Under misty conditions it is left to the pilot to drop lower if objects cannot be distinctly seen. At the altitude of 3000 feet a trained observer can distinguish moving bodies and characteristics of arms, which is all important, since the presence of artillery at a certain point means quite a different state of affairs from the presence of cavalry or infantry, and requires different action. Only a part of the observers acting in this present war had had experience, and the results would have been mournful for airscouts had it not been that there was likewise a lack of experience in shooting against aircraft. Reports in the first month told that the airscouts of both sides, probably in efforts to make up for their lack of experience, flew very low, mostly at from 1500 to 2000 feet. The fact that only a score out of 500 were brought down shows that the shooters were not in a position to take advantage of their inexperience.

Perhaps what the airscout sees from the air is best explained by information of what he may not

see under certain circumstances. The following notes issued by the British War Office to guide officers in charge of troops whose movements are being observed from aircraft give a good idea of the possibilities both ways. The notes are as follows:

1. The accurate observation of bodies of troops largely depends on two circumstances: (*a*) The background, that is, the colour of the ground on which the troops may be at the moment; and (*b*) Movement, *i.e.* troops on the move are far more easily seen than when they remain absolutely still.

2. A column of troops moving along a white or light-coloured road can be easily seen from almost any height, whilst an extended line of infantry scattered on the grass amongst small bushes will seldom be detected if they remain still. Troops should on no account look up at aircraft, for nothing is more conspicuous than men's faces.

3. When troops are marching along a broad road it is advisable that strict march discipline be maintained, the troops being kept well to one side of the road, so that the remaining side, if kept absolutely clear, will look like the whole of the road, and will probably not attract the observers' attention.

4. Troops in column of route on a narrow road may escape observation if they at once take cover on either side of the road, and remain absolutely still, close under the hedges.

5. Woods, belts of trees, high hedgerows, and villages all offer complete shelter from observa-

AN AERIAL DESTROYER

A French monoplane of Nieuport design, armoured and carrying a rapid-fire gun, and capable of doing 100 miles an hour

tion if taken advantage of when the aircraft is still at a distance.

6. When moving over country in extended order or in small columns, troops should take cover under the nearest trees, hedgerows, or patches of gorse and bushes, lying still, close under the edge of such vegetation, until the aeroplane has passed on.

7. Formed bodies of infantry must be got under trees or into woods if they are to escape observation, for in the open they are certain to be seen.

8. Artillery will probably be unable to conceal either their guns or their horses, except in very favourable country where trees are numerous and the view much restricted. Guns in the open will no doubt be easily seen, and the only hope of concealment is to occupy a position close up to a hedgerow and fire through it.

9. When troops are in camp, or in bivouac, every endeavour should be made to alter the usual formations with a view to deceiving the observer, and causing him to mistake one unit for another, *e.g.* a battery for a Field Company, R.E. Guns can be covered with tarpaulin or hay. Where feasible, cooking should be done near villages, so that the smoke does not attract attention.

10. The question will often arise as to how long the presence of a hostile aeroplane is to be permitted to interfere with or paralyse the manœuvre which may be in progress. Time may be a more important element than discovery, and brigade commanders must judge whether it is more advisable to delay the movement by taking cover and remaining hidden, or to continue the manœuvre.

As General Bonneau, of the French army, expressed it after using aeroplanes in the manœuvres: "With the aeroplane everything is seen by the eye; nothing is left to guess." With the aeroplanes there are no military "curtains," nor any covers that can hide from the chief of the army the depth, width, and composition of opposing forces, the position of their reservations, their evolutions in front and rear. The general who knows how to use aviators will always be posted from instant to instant of the movements of the enemy.

But although the greatest influence the aeroplane has in war comes from its almost instantaneous scouting abilities, enabling generals to improve their strategy, it also is extremely useful in aiding the tactics employed on the battlefield. It is of particular service to modern artillery, which usually fires from a concealed position at an enemy which the gunners cannot see. It is often difficult even for the officers of a battery to gain a position from which to observe accurately the results of their battery's fire. But nothing obstructs the observation of an aeroplane hovering over the battle.

General Brun, the head of the French army in 1910, was responsible for the first experiments with aeroplanes to direct this fire.

Colonel Estienne, who supervised special trials, wrote:

"From the time guns were invented no device or technical invention has been developed which increases the efficiency of artillery as much as the aeroplane does."

FRENCH AEROPLANES PATROLLING THE SKY ABOVE PARIS

These small craft have been successful in preventing attacks from Zeppelins, as well as serving as scouts upon the enemy's movements

One aeroplane is allowed to each battery. When the battery is ready for action the aviator connected with it is in the air and has with him small maps or topographical charts on which the object to be hit is marked, if its location is known. If it is not known he finds its location and indicates it on the map which he drops down in a special tube. When wireless is used he reports the location that way. Then he is ready to watch the firing. At a given signal the aviator flies over the battery which fires two shots, one short and one long. The aviator notes the results, marks the location of the hits on the chart, or reports by wireless. The officer directing the fire thus gets the exact results of the firing and rectifies the range accordingly. The night work of artillery has been directed entirely by aeroplanes, which on discovering the location of the enemy fly over it and drop flaming torches or coloured fire bombs. The following report from Soissons, dated September 17, gives an idea of what the effect has been :

"Last night an airscout located a train filled with retreating German soldiers, and the pilot dropped a torch to indicate the range. Our artillery blew the train to atoms in a few minutes."

Using aeroplanes in connexion with artillery, to find the range and "spot" shots, has made the later period of the war, that which followed the check of the Germans by the Belgians, remarkable for its swiftness in taking fortified places. The aeroplanes have supplied infallible eyes to the big siege guns, and have more than doubled the efficiency of gun-firing. To realize the extent of

the economy of this we need but consider that an aeroplane costs only as much as a single shot of a 14-inch gun! All sides, with the possible exception of Austria and Russia, are using aeroplanes with their big guns—insufficiency limits a more extensive employment.

Naval aeronautics have not yet figured in the news from the front. But it must be remembered that to the date of this writing there have been no serious engagements. It is quite possible, as a matter of fact, that the airscouts are responsible for the inactivity.

England at the start of the war had powerful and well organized naval aviation corps. Six naval aviation centres have been established in the last year at Grain Island, Kent; Calshot, Hants; Great Yarmouth; Felixstowe; Fort George and Dundee.

Besides there were two hangar-ships for use as mother-ships, to go with the fleets. The seaplanes, of which there were about two hundred available, are very efficient craft, mostly high-powered, armoured, equipped with wireless apparatus and quick-firing guns. None of the other countries has developed this arm as extensively and efficiently as Great Britain. Most of the other countries have confined their development to using water aircraft for coast defence; and Germany relied almost entirely on the alleged superiority of her naval dirigibles, the Zeppelins L1 and L2, which met with mishaps; and, subsequently, on the L3 and the *Schütte Lanz*. Only recently it was thought advisable to give inducement for the development of seaplanes.

TWO SMALL MILITARY ZEPPELINS

The Zeppelin factory at Friedrichshafen and a new factory at Potsdam are now making six dirigibles a month for the use of the German Army and Navy

The British naval airscouts with their swift and armed seaplanes also seem to have shown capability to fight the Zeppelins, and the German authorities very wisely have not risked them. All the Dreadnoughts are, besides, protected from dirigible attack by guns, and some by armour.

The flagship of the first fleet, the *Iron Duke*, is protected by both armour and guns against overhead attack.

Since the beginning of the war there has been expectation of night attacks by Zeppelins on Paris and London and the Allies' sea-fleets, the notion being that something of a general destruction would result. If such things were possible —if half a dozen airships costing altogether less than half a million pounds, manned by 150 men, costing comparatively nothing to operate, could bring such results, then surely it would be rank waste to have Dreadnoughts. It would be cheaper by far to have transports with aerial escorts.

However, the dirigible has not accomplished what was expected of it. Its potentiality has been restricted by the aeroplane. So long as battleships and cities had nothing but guns or slow aeroplanes to defend themselves with, the dirigible loomed as a terrible menace; but with the present-day armoured and armed seaplanes and aeroplanes capable of a speed of ninety miles an hour and of staying in the air for hours, and of flying at night as well as by day, the dirigible's safety is endangered unless it is accompanied by aeroplanes to defend it. The two hours

required to take it out of the hangar and start it form a handicap in scouting work, and the aeroplane is preferred.

A year ago the declaration of war would probably have been followed by an attack on London and the English coast by the dirigibles stationed at Cologne, Heligoland, Kiel, Cuxhaven, Wilhelmshaven, Düsseldorf, and Frankfort. But last year the British authorities took notice of the fact that Germany had faced Great Britain's new strategic frontier with the best of her aerial fleet and organized the powerful army and navy aircraft corps. London is only 300 miles from Cologne and less than 100 miles more from Düsseldorf, Wilhelmshaven, and Cuxhaven, and though Zeppelins could cover that distance easily it is not likely that they will. Nor is there much likelihood of an attack on Paris by many Zeppelins.

The dirigibles of Metz, Strassburg, and Mannheim could reach Paris, which is between 200 and 250 miles away, in from four to six hours, which is not a long cruise for a Zeppelin. Starting from their hangars at seven o'clock in the evening they would arrive over Paris after midnight; but could hardly be back to the German lines, after delivering the attack, before daylight. On the way they would be exposed to aeroplane attacks and the odds would be against them.

At night a Zeppelin makes a large outline against the sky, whereas an aeroplane cannot be seen approaching. An aeroplane can fly all around a dirigible at dusk, and the defenders of the dirigible would have difficulty to follow its movements. On the other hand the Zeppe-

ARMED TO ATTACK ZEPPELIN WAR BALLOONS

An armoured Deperdussin monoplane that is capable of travelling 120 miles an hour

lins, being close on 500 feet in length and more than 45 feet in breadth, make rather vulnerable targets for present-day guns. Taking all in consideration it seems that though raids might be made on large cities and a few non-combatants may be killed, the gain from such raids would hardly be worth the risk. Until fleets of from ten to twenty dirigibles can be sent out to make raids, or their speed is increased to seventy-five miles an hour—which, however, may come soon, even before the war is over—the dirigible's activity will be confined. Its present position compared with the aeroplane is very much the position of a large and slow transport equipped with guns against a fast small cruiser.

The slow aeroplane with a speed of up to sixty miles an hour has not, however, any advantage over the dirigibles of fighting size. The Zeppelins, the *Schütte Lanz*, the latest *Astra-Torres*, *Lebaudy*, *Clément-Bayard*, *Parseval*, and other types, have armoured carriages and carry guns. The carriages are so placed that expert gunners can shoot in every direction except straight up, and this direction is taken care of by gunners on top of the gas bag, who reach this position by a ladder that goes through an opening from bottom to top of the gas bag. What a dirigible can do to a slow aeroplane can be judged from the results of experiments at shooting at moving targets conducted in the last eighteen months. In an experiment with the army Zeppelin Z5, just before the war, the following manœuvres took place.

A box 30 feet long, 15 high, and 18 feet wide

was suspended from a balloon at a height of 1000 metres (3280 feet).

The wind was strong and moved the box, so the difficulty of hitting it was little less than hitting an aeroplane. The dirigible circled around the balloon, and fired at 4000 feet distance, first 50 cartridges with a machine-gun, then with a cannon. The balloon was then pulled down and they found that almost all the bullets had struck. The balloon was sent back to an altitude of 1200 feet, the dirigible went up to a height of 2200 feet and fired 15 cannon shots from a distance of 6000 feet. Two-thirds of the shots were effective, three striking the black spots which represented the pilot and motor. The manœuvre was repeated as a distance of 7000 feet with the same results.

Outside of the exploits of the few Zeppelins which dropped bombs on Antwerp and several other cities, terrorizing inhabitants and killing a score of harmless people, little has been heard of dirigibles. But they have been active and have many exploits, long distance reconnaissances which could not yet be performed by aeroplanes, to their credit. The German Zeppelins, the *Schütte Lanz* and the *Parsevals*, the French *Fleurus*, *Adjudant Reau*, and the *Spiess*, and the British *Astra* have made long reconnaissances, some extending through an entire night, during which they maintained constant communication with headquarters by wireless. As winter approaches and nights are longer and the movements of troops slower, the dirigibles will be most active, as active as the aeroplanes allow them to be.

A ZEPPELIN DIRIGIBLE, PHOTOGRAPHED FROM AN AEROPLANE

The picture gives a good idea of the enormous target a Zeppelin offers to an enemy's comparatively microscopic aeroplane

The following estimates made from reliable official but unpublished reports and knowledge of conditions and aeronautical plans of the nations give the aerial strength of the belligerent nations at the beginning of the war. It must be added that for two years Germany and Russia have kept their progress in aeronautics secret; last year England and France limited the nature of developments which could be made public. Only the few people closely connected with the aeronautical circles of different countries know of the developments that have taken place. The only official figures outsiders can get are the official reports published at the end of the year 1912. Hence to the outside world France has approximately 500 aeroplanes, and England barely more than 100. These figures are incorrect. They represent only a fraction of the actual strength, as the writer has ascertained. For example, in the debates over the organization of the aeronautical branch of the French army at the Chamber of Deputies it was shown that the French army bought 300 aeroplanes in 1912, and 336 in 1913, and 208 were bought with the money collected by public subscription. This gives 844 machines to the French army without counting the large acquisitions of 1914.

The strength of the British Navy and Army can be gauged by the following statements made by Mr. Winston Churchill and Colonel Seely to the House of Commons last February. Replying to questions in the House as to the number of airships owned or being built for the Government, Mr. Churchill stated:

"There are fifteen dirigible airships built,

building, or ordered at the present time for the naval wing."

From similarly reliable official but unpublished reports and knowledge of conditions and aeronautical plans of the nations, the writer estimated their strength as follows:

France: aeroplanes, 1200 military, 500 added during the period of mobilization by acquisition of private machines and output of factories. Dirigibles, 12 of close to 400 feet in length; 14 of less than 300 feet in length; 5 privately owned, or 31 altogether.

Germany: aeroplanes, 600 military, 400 added during the period of mobilization by acquisition and output of factories. Dirigibles, 12 Zeppelins of from 350 to 490 feet in length; 23 dirigibles of other types, including those privately owned.

Russia: aeroplanes, 800 military, 150 added during the period of mobilization. Dirigibles, 16 of different types, but mostly under 250 feet in length.

England: 200 navy seaplanes; 300 army aeroplanes; 300 added during the period of mobilization. Dirigibles, 15, mostly new, up-to-date machines acquired in the last twelve months.

Austria: aeroplanes, 350, of which all but 100 were acquired at the beginning of hostilities. Dirigibles, 8, mostly less than 300 feet in length.

Belgium: aeroplanes, 40, and 40 acquired at the beginning of hostilities. Dirigibles, 2, one medium size, and one small.

Servia: aeroplanes, 40, dirigibles, none.

A RUSSIAN SEAPLANE

These forces were divided in each country in units composed of between one and six squadrons of eight aeroplanes each and one or two dirigibles and were stationed at aerodromes near military centres.

H. W.

BRITAIN'S CONTROL OF THE SEA

THE GREATEST ILLUSTRATION HISTORY AFFORDS OF WHAT SEA-POWER MEANS : LORD FISHER'S REVOLUTIONARY CHANGES IN THE NAVY : PROBABLE DISPOSITION OF THE ENGLISH AND GERMAN FLEETS : STRATEGICAL SIGNIFICANCE OF THE KIEL CANAL : THE POSSIBILITY OF A GREAT NAVAL ENGAGEMENT

More than eleven hundred years ago King Offa, of Mercia (one of the old English Kingdoms) formulated the military programme that his British descendants have so wisely followed ever since. At that time Charlemagne, one of the predecessors of the present German Emperor, had determined on the invasion of Britain. King Offa constructed a fleet that represented the most approved Dreadnoughts and battle-cruisers of his time; in consequence, the continental war lord did not make his threatened invasion. "Offa bequeathed to England," says the *Anglo-Saxon Chronicle*, recording this event, "that he who would be secure on land must be supreme on sea." England has taken this lesson closely to heart through all the succeeding centuries. When the British Government, on the outbreak of the present war, ordered its commanding admiral "to capture or destroy the enemy's fleet," it was only

expressing, in other words, Nelson's favourite maxim: "Our first line of defence is close to the enemy's shore." The most dramatic episodes in the war have been the struggles on land—the bloody swaying back and forward in Northern France of the death-gripped armies. The most impressive episode, however, is the spectacle upon the seas. So far England's naval victory has been an almost bloodless one; it is a victory none the less. The sinking of British and German cruisers by submarines, startling and tragic as these events may be, are, after all, only episodes in the general situation. The British fleet, remaining almost quiescent in the North Sea, still lords it over the ocean.

Lord Fisher's work as First Sea Lord in 1904 has given England its present predominance. The strength of Britain's position at the outbreak of war was that the fleet was concentrated in the North Sea. Had England suddenly found herself in conflict with a first-class naval Power twelve or fifteen years ago, she would have had no such advantage. For many years the Admiralty had been ignoring the great lesson learned in the Napoleonic wars—the necessity of massing her ships. The English naval forces before 1904 were scattered all over the world. There was a "Home" fleet, an Atlantic fleet, a Mediterranean fleet, a China fleet, and miscellaneous assortments of cruisers—out-of-date vessels—at several other points. England's greatest single fighting force was not located in the Channel, but in the Mediterranean. Here were the great effective battleships, the main line of defence, with Malta as their base.

That is, England was leaving English waters virtually unprotected and concentrating several hundred miles from home. To-day this disposition strikes one as absurd; ten years ago, however, the explanation seemed plain enough. The Mediterranean fleet protected England's trade route to the East through Gibraltar and Suez. It gave immediate communication with India, and protected that part of the empire from attack by Russia. Captain Mahan, of the United States navy, constantly pointed out that this scattering of forces menaced the British Empire. The first rule of naval strategy, he insisted, was to keep the fleet together in one place, where it could do the heaviest damage; not to scatter it where the enemy could destroy it in detail. Certain national crises emphasized the same point. Supposing, for example, that England and France had gone to war over the Fashoda matter in 1898. While diplomatic negotiations were pending, Russia informed Lord Salisbury that, in case of hostilities, the Slavic Empire would align herself with France. The Russian fleet, in those days before the Japanese War, was by no means a negligible fighting force. Nor was that of France. Russia would have immediately steamed south to the North Sea, and France north; these two fleets would have caught the weak home forces of England between them and, in all probability, would have destroyed them. Russia and France could then have turned south and engaged the Mediterranean squadron, certainly with chances of success. The world would have had a splendid illus-

tration of the value of attacking one's enemy in detail.

To-day, efficiency and preparedness seem synonymous with the British Navy, and it is, therefore, scarcely believable that, only ten years ago, these conditions prevailed. When Lord Fisher became First Sea Lord in 1904, a revolution in naval arrangement took place, for he began to gather in the scattered contingents of the Navy and to mass them in the section where, in case of difficulties, they would be immediately needed—that is, in the North Sea. The Navy's chief occupation, in his view, was to protect the British Isles, their food-supply and their commerce, and this they could do most effectively if placed in immediate touch with their native land. The new foreign policy of Great Britain greatly facilitated his scheme. England's alliance with Japan made it less necessary to have a large naval force in Asia; Japan practically undertook the protection of British interests in Chinese waters—a task she at present seems to be fulfilling capably. The Entente Cordiale with France similarly decreased the danger of an attack on England in the Mediterranean. A better understanding with the United States indefinitely postponed any likelihood of difficulties in that direction and so made rather absurd a heavy squadron in the North Atlantic. The creation of the German fleet, an entirely new element in the international situation, also emphasized the necessity for a change. Lord Fisher, therefore, made his new dispositions. Instead of the Mediterranean, the North Sea became the headquarters of the British battle force. In 1899

there were eleven battleships in the Mediterranean, the strongest in the line; in 1910, the same squadron dropped to six—and all these were of distinctly inferior power. In addition, Admiral Fisher organized a so-called "pivot fleet" in the Atlantic, so disposed that he could use it to reinforce either the Home or the Mediterranean squadrons. He withdrew an isolated squadron from the Pacific, and established an Eastern fleet of strong cruisers, for China, the Cape of Good Hope, Australasia, and the East Indian stations. Lord Fisher did far more than this in the renovation of the British Navy; he was the man who started the building of Dreadnoughts, battle-cruisers, and other new and successful types.

There was much disagreement as to the wisdom of these changes; both naval experts, like Lord Charles Beresford, and those interested in outlying British possessions, criticized them as unwise. Recent developments, however, have demonstrated that Lord Fisher fairly well understood what he was doing. He had planned ten years ahead for precisely the contingency which has now arisen. As a result, although, according to tradition, the German officers have been drinking for years "Am Tag" ("to the day"), the "day" being the occasion when the German fleet could come to grips with her English enemy, this fateful time has not yet arrived. Both the German and the English fleets are massed; and a battle royal, unless under exceptional circumstances, is not regarded as likely.

There is much speculation, however, as to the disposition of these giant armadas. No one,

except those immediately concerned, claims to know. The world has never seen the like of the censorship which regulates this war. And this censorship falls heaviest upon the naval operations, mainly because it is easier to conceal the movements of ships than those of armies. Nevertheless a careful consideration of the problems involved gives some idea at least of where the naval contingents ought to be. England's aim was clearly expressed in the order issued to her fleet: to capture or destroy the enemies' forces. Germany's problem is the defensive one of preventing such a capture or destruction, and to inflict such damage as she possibly can to the British ships by attacks with torpedo boats, submarines, and mines. With these prime ideas in mind, the naval experts can figure pretty closely as to where the forces ought to be. England seems determined, at all costs, to conceal her naval whereabouts; in announcing important events, such as the sinking of the *Amphion* and the cruisers *Aboukir*, *Cressy*, and *Hogue*, she has carefully refrained from telling where it all happened. The German ships are concealed somewhere; the possibility of going into harbours for them—repeating the famous tactics of Sir Francis Drake, who didn't hesitate, in his determination to "singe the Spaniard's beard," to enter the harbour of Cadiz itself—seems not to be the English plan. An attempt to "singe the German's beard" in this fashion, with their mined harbours and land fortifications, hardly seems probable. Under present conditions, even a dare-devil sailor, like Drake, would find it a difficult task. A Farragut

might "damn the torpedoes" and enter the Elbe; still, even though he escaped destruction from the mines and land fortifications, he might have nothing to show for his pains. When he arrived in his destined harbour, the enemy, in all probability, would have disappeared.

The Kiel Canal Doubles German Strength

The Kiel Canal is the answer to those who advocate a "beard-singeing" policy. A glance at the map explains the decisive part this plays in the present operations. Its western entrance lies about thirty miles within the Elbe River, a stream difficult to navigate, even when there are no mines and land fortifications. From here it extends in a north-easterly direction for eighty miles until it enters the Baltic at Kiel. Consider now, for a moment, what would happen should Admiral Jellicoe adopt the programme suggested by Mr. Churchill in a recent speech and attempt to "dig the Germans out like rats." If he sought them in the River Elbe, the German battleships, assuming that they were stationed there, would quietly slip into the Baltic end of the canal. The wildest advocates of an aggressive policy would not suggest a pursuit further—this form of suicide strikes no one as sane seamanship. On the other hand, imagine that the British ships enter the Baltic through the Skager-Rack and Cattegat, the exceedingly difficult and dangerous strait that separates Norway and Sweden from Denmark. By the time the English reached the Baltic waters the Germans would have slipped through the canal into the River Elbe again. Such a game

of hide and seek could have no result that would not be disastrous to the British Navy. Indeed, the English would have only one possible move: to split their forces into two parts, one to search out the Germans at the Elbe, the other to enter the Baltic. That is precisely what the Germans would like to have them do. The Germans could then engage England on more than even terms; could bring the whole of their ships to bear against half the British—assail them, that is, in detail. The Kiel Canal was built for the particular purpose of splitting the British Navy; in other words, of doubling the fighting power of the German fleet. It accomplishes for German defence precisely what the Panama Canal does for the defensive powers of the American navy. Not the least significant fact in the present situation is that the Kaiser did not go to war until this canal was finished—in its reconstructed form. It was formally opened in June 1914, about a month before the famous ultimatums were sent.

In the present difficult situation, therefore, one thing may safely be assumed: England will not play into Germany's hands by dividing its fighting fleet into two parts. That would undo all the preparatory work of Lord Fisher, already described. Her main policy seems to be a waiting one: to pen up the German fleet; to render it useless in the present struggle; to prevent the escape of any part of it, such as a cruiser squadron, into the Atlantic, where it might prey upon British commerce, and perhaps engage the British cruisers which are patrolling the trans-Atlantic lanes; and to hold itself in readiness for any

possible desperate attempt the Germans might make at an engagement. Its position is obviously the one place where it can best accomplish these purposes. It has to watch two places: Wilhelmshaven and the general region at the entrance of the Elbe River and the Kiel Canal; and the Skager-Rack. Any dashes which the Germans make must come from one of these two points. According to naval experts, a place midway between the two is naturally indicated as the position for the heavy British ships. There is thus a prevailing belief that the main strength of the English is located somewhere in the upper half of the North Sea, the northern section of which is about equally distant from the German and the English coast. The shallow water would furnish excellent anchorage for a fleet of battleships. Such a squadron, stationed in this spot, would be in instant readiness to meet a German sortie from either point. The naval strategist is, therefore, pretty likely to locate the British battleships in these waters. Others believe that it lies safely protected off some British harbour, completely ready to go into action. What one has in mind in discussing this situation, of course, is the efficient fighting contingent, that is, the battleships. These are screened by the usual cruisers and torpedo flotillas. It may also be safely assumed that there are other cruiser squadrons at advantageous points, such as the English Channel and the waters in the north, to prevent any raiding expeditions of German cruisers. The force which made the raid into Heligoland, sinking three German cruisers and two destroyers,

and the one that had an unfortunate tussle with German submarines, losing three cruisers, probably represented these outlying expeditions. That a squadron of cruisers is patrolling the Atlantic trade routes is also no secret.

Where the German Ships Lie

These being the probable dispositions of the English ships, where do the naval experts place the German? We may take it for granted that the main purpose of the Germans is the same as that of the English; that is, to keep their fleet together, to hold it as a single unit for the time when it may be called upon to strike. Most writers assume that it is lying somewhere near Wilhelmshaven, or in the Elbe, under the protection of land fortifications. The best authorities regard this as hardly likely. Unquestionably, Germany has cruisers, torpedo flotillas, and submarines at these places, as well as at the naval station of Heligoland, for the purpose of making raids; it is hardly likely, however, that she has located her great fighting forces in these waters. The danger of torpedo attacks would be too great. Indeed, had she risked her battleships anywhere near the North Sea, in all probability British ships would long ago have tried to "dig them out." It is more likely that they are in the Baltic, not far removed from the Kiel entrance to the canal. In the opinion of some observers they may be located directly in the canal itself; if their main object is to hide until the war is over, there certainly they would find their most protected haven. On the

other hand, the necessities of the situation really demand their presence in the Baltic. They have a particular duty to perform here, not unlike that which the English ships have in the North Sea. England has to seek out and destroy the German navy, to which its own is immeasurably superior; similarly the German fleet has to seek out and destroy the Russian, over which it has an even greater proportional preponderance. Up to the present writing it has had about as much success in attaining this object as the English fleet has had in achieving its particular aim.

Little Fighting on the Sea

As is not unusual in time of war, the operations of these great armadas have sadly disappointed expectations. In the last few years both English and German romancers have amused themselves by picturing the approaching naval contest between England and Germany. Many prophetical "Battles of the North Sea" have made their appearance. Nearly all have agreed upon the probable sequence of events. On the declaration of war, the German writers have told us, a German torpedo flotilla would steam into the North Sea and put large numbers of English battleships out of action. Innumerable attacks by destroyers, submarines, and floating mines would follow in rapid succession. Perhaps these torpedo attacks have taken place; the news, however, has not yet reached the public; early German reports of the sinking of half a dozen English battleships off Hull clearly represented not what had actually happened, but what was expected to happen.

Such attacks as have taken place, it may be assumed, have failed; had Germany succeeded, she would not have hesitated to publish the fact. The only events that have even remotely substantiated these early fancies have been the sinking of the cruiser *Amphion*, probably by an unanchored mine, perhaps by a submarine, and of the cruisers *Aboukir*, *Hogue*, and *Cressy* by submarines. These events clearly indicate that Germany is attempting to live up to her generally accepted role in the North Sea problem. The afflicted cruisers represent a genuine loss to Great Britain; the action of the submarines unquestionably indicates seamanly skill of a high order—rather higher than English critics of German sea-power have attributed to her. A successful submarine attack upon outlying cruisers of the third and fourth class, however, is a very different thing from a real penetration of the battleship line. England's real command of the sea rests upon her sixty battleships, her nine battle-cruisers, her fifty-one armoured and heavily protected cruisers. These not only enormously outnumber the German units, but they are larger, swifter, and have more powerful armaments. Unless the German submarines and torpedo boats reach this fighting force, England can stand the destruction of a large number of lighter and obsolete vessels without appreciably endangering her present naval position. Prognostications in a naval situation like this are unwise. If the German navy performs such a feat, however, it will justify all the praise that has been bestowed upon it. For this English battle force is thoroughly screened by

cruisers, torpedo boats, destroyers, submarines, and mines, through which the German attacking force will have to pick its way. The obliteration of a few detached cruisers will be child's play compared to an operation of this magnitude. Unless Germany can do this, however, she can hardly disturb the present *status quo*.

Does this mean, therefore, that the German High Seas fleet is rendering no service to the Fatherland in the present war? Hardly that. Its mere existence in itself constitutes an indispensable service. The outnumbered German fleet, even though it is hardly prepared to take effective action, is a real governing element in the protection of Germany. It keeps the British battleships eternally watchful in the North Sea.

The War Value of the Fleets

As things stand at the present writing the British Navy is the dominating force in this great European war. Naval experts all over the world are gazing at the spectacle with admiration. England, despite the most devastating war in all history, is still going on virtually intact. Its great mercantile fleet is still ploughing all the seas, weakened only slightly by the few ships lost and detached for service in the Navy. Its factories are still getting their raw materials from all parts of the world; the wheels are still turning, hardly interfered with by the war. The nation is still importing as freely as before the food-stuffs essential to its very life. On the other hand its greatest rival has suspended its commercial life. Germany's merchant fleet of 5000 ships is either

lying useless at the wharves of many nations or is falling daily a prey to British marauders. The ordinary newspaper reader cannot faintly picture the extent of this demoralization. In the United States the paralysis is so profound that even a neutral ship will not go to sea with a cargo destined to a port anywhere near the German shores of the North Sea. American vessels are chary of taking cargoes even for Rotterdam, for underwriters can hardly be persuaded to insure such cargoes. A fear simply overhangs the mercantile community that such an enterprise is a hazardous one. German mails have almost ceased. The German cables are cut. German factories are idle. Germany's business organization exists in a state of suspended animation. The Great German economic machine, built up by forty years of aggressive and intelligent enterprise, is lying rusty and unused. The amateur statistician can figure concerning the financial losses. Thus German commerce amounted to about £1,000,000,000 last year; at this rate, its cessation means a loss of about £2,600,000 a day—this in addition to the enormous cost of conducting the war. England's naval preparedness, the battleships she has stationed in the North Sea, has caused this calamity. Should the military operations stop to-day, the English Navy unaided could probably win the war. It would merely have to sit tight in its present position. With the English economic machine running and the German economic machine shut down, time alone would settle the dispute.

British Naval-Military Advantage

But this is not all that England's sea-power has accomplished. It gives England a tremendous military advantage. Because she controls the sea, England has established a ferry line across the English Channel for the transportation of British troops. Two weeks after hostilities began she had 125,000 completely equipped soldiers fighting on the firing line in Belgium. Reports seem to indicate that these troops, arriving at a critical moment, saved the situation for the Allies—that they turned the military balance against Germany in the Paris campaign. Similarly France, a few days after mobilization, was bringing native Algerian troops across the Mediterranean. Sea-power again! England is impressing five continents into the warfare on Germany. Troops have sailed, or are preparing to sail, from Canada, South Africa, Australia, New Zealand, India, and Egypt. All these outlying sections have been suddenly transformed into recruiting stations for the British Army. Every ocean highway has become merely a line of communication leading directly to the battle-front in Europe. And, in addition to all these advantages, this same mastery has enabled Great Britain leisurely to sail the seas, picking up the German colonies.

Will this situation persist indefinitely? Can Germany do nothing, besides attacking with submarines and torpedo boats, to destroy this British sea-supremacy? Nature aids her; the coming winter months may severely try the endurance of the British Navy. No one can com-

prehend how a long, tedious vigil, day after day and night after night, momentarily overshadowed by the fear of torpedo and submarine attacks, gets on the nerves of the hardiest officers and men. This experience will be harder on the English than the Germans, because their position is much more exposed; the "psychological factor," that is, is against them. In the winter months the North Sea becomes more disagreeable; the weather gets cold and dirty, and fogs are an every-day annoyance. After waiting for these influences to wear down the enemy, and after a few more submarine attacks, very likely successful ones, the Germans might suddenly issue forth and tackle the enemy. A daring enterprise of this kind is not probable; it is, however, possible.

WHAT A MODERN SEA FIGHT IS LIKE

WHAT WOULD HAPPEN TO-DAY FROM THE TIME OF SIGHTING THE ENEMY'S SHIPS TO THE TIME HIS LAST FIGHTING UNIT WAS DESTROYED

UNTIL the German fleet comes out into the North Sea or the French fleet engages the Austrian fleet in the Mediterranean, there is only one fleet battle under approximately modern conditions to indicate the character of a fleet action in the present war—the battle of Tsushima between Admiral Togo and Admiral Rodhjestvenski.

Since Tsushima, ships have grown tremendously in size. To-day's super-Dreadnought is of 27,500 tons, as compared to the 13,500 tons of Admiral Rodhjestvenski's flagship. In armour protection and battery power there has been improvement, and in speed the increase has been tremendous. Rodhjestvenski at Tsushima could get no more than 11 knots out of his travel-worn fleet, and Togo's best was 16 knots; whereas the United States recently sold to Greece the old *Idaho* and *Mississippi* (first-class battleships otherwise) because they could steam only 17 knots. The modern battle fleet would go into action at a speed of 20 knots.

Since Tsushima, wireless has been somewhat

improved, the submarine has come into the reckoning, and the seaplane has found a place with the fleet. Yet to-day's story of a fleet battle would not be radically unlike that of Togo's achievement; and in essentials the Japanese admiral followed tactics as old as naval warfare.

A fleet commander's fighting ships are floating gun platforms; if they are modern, they will have the highest speed consistent with the greatest possible concentrated destructive power for battling in all conditions of wind and weather on the high sea. If all these floating gun platforms are ready to take the sea at their best speed, and if they are carrying their best guns and their best trained crews, the problems of battle are reduced to the handling of the ships and the handling of the guns they carry. Most important is the handling of the guns.

This war's battle, if it comes, will be fought between the English blockading fleet and the German fleet trying to run the blockade.

The super-Dreadnoughts and Dreadnoughts (battleships and big-gun cruisers) have been overhauled. Maximum supplies of shells, filled with the highest explosives known to naval use, are in their magazines—they may even carry shells for their 12-inch, 13-inch, and 14-inch guns in most of the magazines designed to supply the smaller guns, for the object of a fighting fleet is to crush the enemy, and a big-gun shell which can tear a gaping hole through armour at 12,000 yards will do more damage than many 3-inch shells.

Off the big fighters has come every bit of wood, decks are cleared, hatch covers bolted, and davits folded down, boats are put ashore along with chests and tables, the officers' furniture, and, on the day of the fight, even the hammocks will go overboard. In the hell-fire which follows the explosion of a shell aboard ship no inflammable thing will go unburned; and fires breaking out on deck or inside the ship are only less disastrous than the enemy's fire. From all except the most modern of the giants the bridges are down, for a portion of them is wood. Days before the battle the crews of the fighting fleet are eating from metal plates, sitting cross-legged on the steel mess-deck; in the wardroom the officers find neither wooden chairs nor tables.

Next to the powerful battleships in importance to the fleet commanders are the battle-cruisers. They are battleships (some of the latest carry twelve 14-inch guns) which have sacrificed armour protection for speed. They are of unequalled value to take care of such of the enemy's ships as have to drop out of the fighting column with battery power crippled; and if it should turn out that the battle-cruiser's effective range is greater than that of the enemy's armoured ships, then she becomes an offensive unit of equal value with her Dreadnought sisters.

Other ships which prepared for battle are the armoured cruisers (a class no longer built); scout cruisers, light, carrying only small guns, but capable of making 27 or 28 knots; torpedo-boat destroyers; and service ships. Among these are tenders, called " mother " ships, for the destroyers

—one to each flotilla of five or six destroyers. On the tenders are constructed the launching and landing platforms for the air scouts. Repair ships and hospital ships complete the fleet.

The threat of Mr. Winston Churchill to "go in and dig out" the German fleet cannot be taken seriously—nothing would suit the Germans better! But out the blockaded fleet must come. A modern navy does not exist to be saved for exhibition purposes after the war is over; its job is to fight the enemy for mastery of the sea. Staying in port is demoralizing to the personnel in time of war. This the commander of the blockaded fleet knows, and he knows, too, that his enemy who is maintaining the blockade is getting first-rate daily practice in handling ships, and hardening and tempering crews out where the fighting will occur.

When the German Fleet Comes Out

So the Germans at some time may be expected out; and without trying to prophesy in detail it is possible to explain the general aspects of what naval experience would teach us to expect would then happen. The Germans will come several hours before dawn, for when the fight begins they want to be quite clear of the port with sea room in which to manœuvre. A tactical advantage rests with the issuing fleet in that the fighting ships of the blockaders must keep as far away from the port as they can and be certain of intercepting the enemy as they come out. During their blockade of Port Arthur, the Japanese battleships remained at the Elliot Islands, sixty-five miles away. By contrast

with the tactics of to-day's blockading commander, Admiral Sampson's ships formed a flat arc within a few miles of Santiago harbour ; and at night two of his battleships actually drew up close enough to cover the harbour entrance with their searchlights. That was all right for Sampson, for he had learned that he had nothing to fear from mines, and that the guns of Moro Castle never fired in attack but only replied to attacks. It is safe to say that English battleships could take no such liberties off the mouth of the Elbe !

Before being discovered by the English scouts, the German fleet would probably be able to pass the clear zone maintained by the opposing submarines and destroyers. Once beyond that, however, the English scouts would sight it. Then would begin the first contest—that between the wireless operators aboard the two fleets. On board the first scout to sight the German fleet, the operator would begin to call the English admiral's flagship ; and at the same time, operators on board the German ships would be trying desperately to synchronize their apparatus and " mess up " (jam) the scout's message so that it could not be understood.

There would be better than an even chance that the German wireless could successfully interfere. In that case, the scout would fly at its highest speed to the nearest tender carrying an aeroplane. Off would wing an air scout ; but knowing that hostile air scouts would likely be aloft and that in thick weather the flying machine cannot be sure of finding its way, the fastest of the scout ships would press on.

Other scouts would hurry forward to observe the strength, disposition, and direction of the German fleet; aboard them would be men trained to recognize, from long study of plans and silhouettes, every ship in the enemy's fleet; aboard the English fleet commander's flagship would be his staff, whose members know the efficiency in speed, armament, and personnel of every ship in the German fleet. They would have charted and plotted every possible battleground. As his scouts brought him news of the progress of the issuing fleet, the English admiral in command would mark its location on his chart and study its formation in reference to his own plan of attack.

Once beyond the clear zone the German fleet commander would change from cruising formation (scouts ahead, fighting ships in double column, cruisers and destroyers alongside, and tenders, service ships, and hospital ships behind, each convoyed by more destroyers and swift cruisers) to column, or "line ahead," as the English call accepted battle formation. One behind the other, as closely as they may safely be navigated (probably not more than 400 yards from bow to stern) would steam the fighting ships. On the fifth ship in line would fly the flag of the admiral second in command, while from number nine would fly the flag of the admiral third in rank—and so on, each division of four fighting ships being under a division commander.

To-day both fleets in a sea battle would have great "mobility"; they would maintain a speed of about 20 knots. England might put more than thirty battleships and battle-cruisers in line capable

of making 21 knots in battle formation; there are seventeen or eighteen fighting ships in the German navy which can steam at nearly 20 knots together. Of course, under these conditions, submarines would hardly play a part in the actual battle, for the best of them now in service are capable of only 18 knots on the surface and 12 knots submerged.

As the German fleet steamed out on its chosen course, its armoured ships riding high enough to show from 6 to 8 feet of heavy armour above the water-line, the English fleet would be coming together in column. Already the admiral in command would know the strength of his enemy, and he would probably retain in his own fighting column only those ships that could outrun the enemy's ships in column. Then he might choose to attack either the head or the flank of the German fighting column.

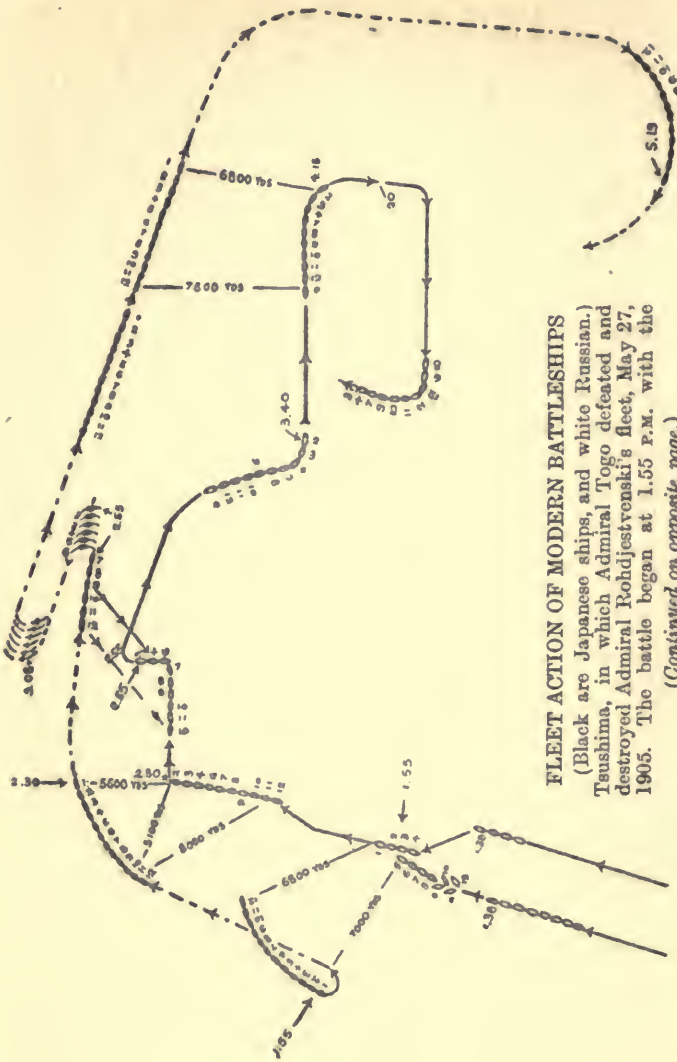
Togo, at Tsushima, did that. He knew that his four battleships and his eight battle-cruisers could hold together at a speed of 16 knots; he knew that the Russian ships, having been long at sea (they left the Baltic naval base at Cronstadt, September 11, 1904, and had been at sea continuously, except for stops in neutral ports for supplies and such repairs as could be made by the fleet's own men), must have foul bottoms, and must be several knots slower than his own. Togo's scouts reported that the Russian ships sat very low in the water—they were overloaded with coal and stores so that their armour belts were just about at the water-line. During Admiral Rodhjestvenski's first manœuvre, before the battle opened, to swing his eight battleships and four armoured cruisers into column, the

best speed he could get from his first division, which took the head, was 11 knots.

Here was a big advantage in speed for the Japanese ships; how did Togo utilize it? From the Russians' right (starboard, if you like), at a distance of about 12,000 yards, Togo sent his twelve ships flying diagonally across the front of Rodhjestvenski's column. When his last ship had cleared the Russian flagship, he turned to the left to run alongside the Russian ships in the opposite direction; with his own ship about abeam of the Russian admiral's, Togo countermarched, turning in toward the enemy in order to bring his ships to a range of 7000 yards.

Steaming alongside, Togo began to forge ahead and bear toward the right; his plan was to "cross the T," or "cap" the Russian column so that the fire from the guns of his fleet could be concentrated on the leading ships of the Russian column. As a matter of history, the fire of the Japanese ships was concentrated first on the fifth ship in the Russian line, which through faulty manœuvring was nearest to them as they countermarched. Within five minutes that ship was disabled; it dropped out of line, and sank within fifty-seven minutes of the opening of the engagement.

Five minutes to dispose of one battleship! Then Togo succeeded in "capping" the Russian column, but as he pressed against the head of his enemy's column, decreasing the range to 5000 yards when he saw that Russian gunnery was as bad as Russian tactics, Admiral Rodhjestvenski ordered a change of course four points (one eighth of a circle) to the right. Too late the change was ordered,



FLEET ACTION OF MODERN BATTLESHIPS

(Black are Japanese ships, and white Russian.) Tsushima, in which Admiral Togo defeated and destroyed Admiral Rohdjestvenski's fleet, May 27, 1905. The battle began at 1.55 P.M. with the

(*Continued on opposite page.*)

and his flagship, upon which the Japanese fire was mainly concentrated, received her worst hurt while running on that course; the change of range, too, affected the efficiency of his own gunfire, for by this time his "fire-control" system was all but useless and his sights were either knocked to pieces or obscured by the clouds of coal dust raised by the shock of Japanese shells exploding on board.

On that day the Japanese introduced to the naval world their new shell—a thin-walled missile a foot in diameter and four feet long, filled with an explosive which broke the walls of the shell into a vast number of fragments and poured out a volume of terrible flame. They exploded on contact—Captain Semenoff, observer aboard the Russian flagship, said that they seemed more like mines than shells, for contact with any obstacle—hand-rails, guys, or funnels—was sufficient to loose their awful charge.

Japanese fleet concentrating its fire on the fifth Russian ship while the Russians were trying to get into line of battle. No. 5 sank fifty-seven minutes after the battle opened. By 2.30 P.M. the Japanese fleet, steaming 16 knots to the Russians' 11 knots, had "capped" the Russian battle-line so that the fire of all the Japanese ships was concentrated on the leaders of the Russian line, while the last Russian ships were nearly out of the battle. No. 2 dropped out of the battle for a while and the Russian fleet tried to go astern of the Japanese, who prevented this by a ships-about movement. By 4.15 P.M. the two fleets were again in range and the superior speed of the Japanese fleet was enabling it to "cap" the enemy again. To avoid this, the Russians practically made a circle. By this time it was dark; the Japanese fleet split and came up on each side of the Russians (not shown in the diagram). The fighting was about over at five o'clock, and though the Russians maintained a semblance of a battle-line the ships were all so damaged that all but five sunk or surrendered; three escaped to Manila and were "interned"; one ran ashore; only one anchored safely in Vladivostok. The Japanese did not lose a ship. The battle was won by speed, tactics, and gunnery. The Russians were superior in armament and guns, with eight battleships and four cruisers to four battleships and eight cruisers of the Japanese.

The first range-finding shots from the Japanese 12-inch guns went over the Russian flagship; Semenoff said that he joked about them with some of the other officers.

The "Portemanteaux" Shells

"Those must be the famous 'portemanteaux,' eh?" laughed one of the Russians.

"Yes, those are the 'portemanteaux'!" affirmed Semenoff, who had been aboard the Russian *Cesarevitch* at Port Arthur, where the Japanese shell had received its nickname. They came, many of them, tumbling end over end, whining instead of coughing as a big-gun shell should.

Presently they began to find the Russian flagship; soon there was a literal rain of fire upon her deck. One of the "portemanteaux" entered a gun port in the forward turret and exploded. Some bags of powder stored inside (where they shouldn't have been) were ignited, and the roof of the turret was lifted; it landed on deck leaning against the side of the turret. On deck nothing but a confused mass of distorted iron; fires were breaking out everywhere aboard—barricades of drenched hammocks, intended as shields from flying steel splinters, flared up an instant after the bursting of a Japanese shell on deck. Soon all the plating forward of the heavy armour belt had been shot away, and the ship resembled a monitor in appearance. Half an hour after the beginning of the battle, the Russian flagship's steering-gear was disabled and she had to drop out of line. By this time only one of her big-gun turrets was left in commission.

Few of the "portemanteaux" shells of the Japanese ships penetrated the enemy's armour belts. They were more like terrible shrapnel fire, disabling the enemy's upper works, jamming his guns and crippling his turrets, cutting his signal masts and tumbling his funnels on deck, spreading destruction among crews with every scattering explosion. Aboard one of the Russian ships, a sailor was hit 130 times by fragments from a single shell!

Twice the Russian admiral in command was wounded; the second time a fragment of shell struck him as he stood inside the conning tower and drove a piece of his skull into the brain; he was carried to a gun turret, for he would not go to the dressing-room to have his hurts examined. There he sat for many minutes, hardly conscious, looking up now and then to ask how the battle was going. His flag still flew from his battered and disabled ship, so that Nebogatoff, next in rank of the fleet admirals, could not come up and take command.

Picking off Ships One at a Time

With the flagship out, number two, which now led the line, received the attention of the Japanese gunners. At that time, so well had Togo's "capping" tactics succeeded, all twelve ships of the Japanese fleet could concentrate their fire upon the leading ship at ranges varying from 5100 to 5600 yards.

Round and round in circles, still battered by fire from the Japanese ships which passed her, steamed the Russian flagship. Two Russian tor-

pedo boats had been instructed before the battle to watch for a possible disablement of the flagship. In that case they were to stand by to take off Admiral Rodhjestvenski and his staff, transfer them to another ship which would then become the flagship. But these boats were not to be seen; and automatically the actual command of the fleet passed to the captain of number two ship in line.

Semenoff said that during the minutes between the disabling of the flagship and the removal at last of the admiral and the two members of his staff that could be found in the darkened ship (one of them was in the lower fighting station of the conning tower sitting beside a lighted candle) the ship was an inferno of fire and destruction. Every big gun was silenced, all signal apparatus was gone, the flag halyards burned, and the sailors were huddled in groups waiting in a stunned silence for a word of cheerful leadership. Down on the mess-deck were standing, sitting and lying, groups of the wounded. They began at last to feel their hurts, and "the dreadful noise of deep sighs and half-stifled groans was audible in the close air. Ahead somewhere, in white coats stained with red splotches, busy figures of surgeons moved about, and toward them all these piles of flesh, clothes and bones turned, and in their agony dragged themselves."

A Japanese shell finally penetrated the armoured deck and tore a hole through which the water began to pour. The commander of the signal corps gathered a group of his men and started down a hatchway to help to repair the rent;

another shell dropped, and when Semenoff could see, after the smoke had cleared, there was no commander, no squad of signal men, no hatchway ladder!

Playing "Follow the Leader" With Death

It became apparent to the captain of number two ship, now at the head of the column and directing the one manœuvre possible, that of "follow the leader," that his position was untenable. He turned sharply to the right, the remaining nine ships, all battered and on fire, following. For twenty-five minutes he steamed on this course, while the Japanese column raced to maintain its position as "capper." As the ships of Togo's fleet drew far up and crossed the "T," the Russian captain made a quarter turn to the left, to dodge behind and attack the rear of the Japanese column. Togo met this by a "left about," thus shifting his column to the Russian's right.

That would be no better for the Russian commander, so he turned again, this time more than eight points to the right, in an effort to bring his ships to closer grips. Togo led his ships in another ships-about movement toward the right. At this point number two in the Russian column caught fire—the paint, which was too fresh, on her exposed side was blazing furiously, and she had to drop out of line to extinguish the blaze. She was out nearly an hour, and meanwhile number three came up to head the line. This was only forty-five minutes after the first Japanese ship opened fire.

As the Russians turned to the right in this last manœuvre, they passed opposite to the Japanese

still making their left-about movement. Number four in the Russian line offered the best target. In six minutes twelve 12-inch shells struck her. Before the battle ended, thirty-four fires broke out aboard number four. Three of these broke out among the hammocks piled just forward of the bridge, others started from the hawsers. Three times smoke from such fires drove the occupants from the conning tower; once smoke from a hawser fire was drawn down to the forward engine-room by the blowers, and this compartment had to be abandoned. But number four stood up under the pounding, survived the night of May 27, and was surrendered to the Japanese next day.

On a diagram of the battle you may follow in detail the movements of the fleets. The weather was thick, and between five and six o'clock, after three of the Russians' ships had been sunk, the Japanese lost sight of the Russians, command of whom had at last been turned over to Nebogatoff.

Those on board the torpedo-boats could tell about the sinking at 5.30 of the ship whose side had taken fire because of fresh paint; they had details, too, of the sinking of that unlucky number five which first became the target of the Japanese guns at 1.55, and went down at 2.52. From the deck of the torpedo-boat Semenoff watched the abandoned flagship. It was growing dark—along the line of the Japanese ships flashes from their guns twinkled incessantly. At seven o'clock, a Japanese torpedo-boat destroyer steamed near the flagship. But on that wreck aft was still one serviceable gun; it was trained on the threatening destroyer. The Japanese drew off to wait for a

more favourable opportunity to deliver *a coup de grâce*. On board the torpedo-boat, some one shouted to Semenoff:

"The *Borodino*—look!" The *Borodino* had been number three in the Russian column. Semenoff raised himself on his hands (his legs were both stiff from wounds), but where the *Borodino* had been nothing was visible save a patch of foam!

Three Russian fighting ships went down that day. When the Japanese fleet lost the enemy's column, it separated in two divisions. Under Admiral Kamimura, a division of six cruisers ran into the cruiser and supply ship squadrons of the Russians. Kamimura fired upon them, destroying and scattering them; then Togo, coming to the scene of the firing, ran again into the fleeing Russian battleships. There were more shots poured into the crippled fleet before Togo drew off and left the field to his torpedo-boat destroyers. During that night and the following day, the job was finished. On May 28, four wrecks of the Russian battle fleet were surrendered to the Japanese; four others were sunk by gunfire and by torpedoes, one was scuttled by her crew; one got away, but ran aground because her compasses had been disarranged and was sunk later; one ship only of the Russian fleet got safely through to Vladivostock, the port to which the Baltic fleet had been bound; and three cruisers got to Manila, where they were "interned."

On the Japanese side, only one of her fighting ships, a cruiser, was temporarily disabled by the Russian guns; she left the column for a time during the fight, but came back.

Except for the surprising breakdown of the Russian fleet in tactics and gunnery, the battle of Tsushima would stand as a fair picture of a modern fleet engagement.

The German or the English would hardly repeat the mistakes of Rodhjestvenski. The loser would fight his ships far more intelligently.

We are waiting for such a thing as happens only once or twice in a hundred years. Between Trafalgar, 1805, and Tsushima, 1905, only two fleet battles on a large scale were fought. The Austrians defeated the Italian fleet at Lissa in 1866, Japan crushed China's navy in 1894, at the Yalu.

The English fleet has before it the same task that it had at Trafalgar, nearly 110 years ago. Its commanders must be ready to crowd into the few minutes of actual fighting that mean the Empire's life or death, the lessons of countless drills, of a constant preparedness.

The German fleet has before it the task of defeating the greatest navy in the world, of putting skill and study enough into their action to overcome the disparity of the two forces.

J. M. O.

A NEW ROLE FOR SUBMARINE MINES

THEIR USE FOR OFFENSIVE WARFARE : A LESSON TAUGHT BY THE RUSSIAN-JAPANESE WAR : TORPEDOES AND MINES AMERICAN INVENTIONS : DAVID BUSHNELL AND HIS "TURTLE" : ROBERT FULTON AND SAMUEL COLT : THE HAGUE'S DECLARATIONS ON THE USE OF MINES : GERMANY'S REFUSAL TO ACCEPT ANY RESTRICTIONS

ALMOST every day stray newspaper paragraphs are revealing a situation that strikes most observers as a particularly revolting form of warfare. An innocent North Sea trawler hits a floating mine, splits in two, and sinks, frequently with the loss of everybody on board. The iniquity of this proceeding consists in the fact that these victims are not ships of war, are often neutrals, and are exercising the unquestioned rights of neutrals to sail the open seas. The casualties, which are increasing in numbers, indicate clearly that some one is sowing the North Sea more or less freely with floating, unanchored mines. Primarily this belligerent intends these engines of destruction for ships of the enemies' fleets; the fact is, however, that they are just as likely to sink neutral vessels. There is little question, of course, as to which of

the warring nations is planting these mines. Germany is the only one that can chiefly profit from such operations, as the waters in which the explosives float are frequented mainly by British warships.

The Hague Conference formulated certain rules for the regulation of mines. These prohibit the laying of any kind of mines, anchored or unanchored, in the high seas, except within the immediate area of warlike operations. Germany strongly objected to these regulations, and agreed, instead of accepting the Conference's stipulations unconditionally, to observe them for five years. This period expired in 1912. The German navy is, therefore, free so far as its plighted word is concerned now to use unanchored mines in the present war.

Mines have an interesting and romantic history; for their beginnings, we must go back to the American Revolutionary War. An ingenious undergraduate of Yale, David Bushnell, worked out the idea while still a college student. "Bushnell's Turtle," which he constructed, represented not only the first attempt at a submarine mine; it was also the world's first submarine boat. These two deadly engines, which play so important a part in the present struggle, originated in the same brain and at the same time. Bushnell's chief ambition was to construct a receptacle containing an explosive, which he could set off under the enemy's vessel—the submarine boat was built merely as a method of putting this engine in position. The whole contraption, according to contemporary descriptions, was shaped something

like a " round clam." The vessel was large enough to hold a man in sitting posture ; its elevation and submersion were accomplished by letting water in and out ; it had an elaborate mechanism for steering and propulsion. The navigator worked a couple of treads with his feet after the present fashion of running a sewing machine ; this started a couple of paddle-wheels on the outside, which furnished the vessel's motive power. The exterior wall held in place a large keg filled with gunpowder, ignited by a fuse ; at the critical moment, the inmate released this, backed away quickly so as to save his own skin, and calmly awaited the pending destruction. Bushnell, after many experiments, finally made a night attack on the British cruiser *Eagle*, anchored off Staten Island. His submarine worked successfully ; his torpedo exploded according to programme ; owing to some mistake in calculation, however, it did not go off directly under the British vessel, but at a little distance away. All that Bushnell got for his pains, therefore, was a loud report and a huge geyser. The English seamen, although not destroyed, were considerably amazed. They had never dreamed of anything like this. The performance had about the same effect upon them that the appearance of the Zeppelins has had in the present war, the only difference being that they expected the Zeppelins, whereas Bushnell's torpedo took them entirely by surprise. Later in the war Bushnell let loose a fair-sized flotilla of his torpedoes against the British fleet at Philadelphia ; the vessels, retiring in time, destroyed the new enemies, however, by letting loose all their broadsides. This " Battle of

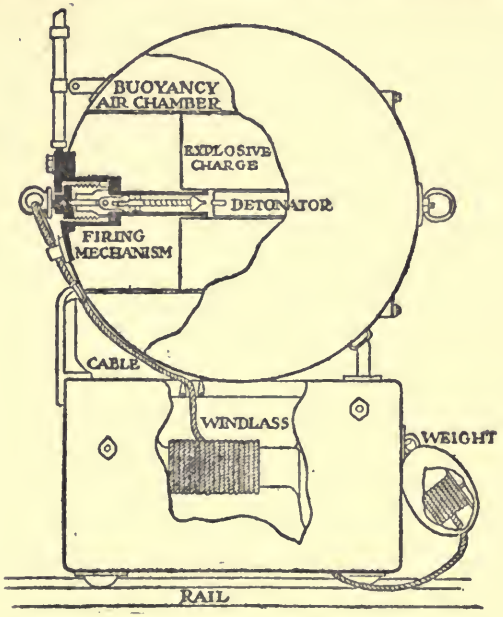
the Kegs," immortalized in a popular ballad of the day, represented the first use in history of floating torpedoes.

Bushnell's invention, though it apparently never succeeded in destroying a British ship, kept the English in a state of nervous excitement all through the war. They denounced it as a Yankee "infernal machine," and as outraging all the decencies of humane warfare. Robert Fulton, who took up the machine where Bushnell let it drop, met the same hostility. He conducted many experiments in France, and blew up several derelict vessels in the harbour of Brest in 1801. The French Government, however, refused to adopt the contrivance, chiefly because Admiral de Pelly had "conscientious scruples against such a terrible invention." Fulton then took his idea to England, where likewise he had a cold reception. The English frankly said that they had no interest in encouraging a system of warfare that threatened to destroy its supremacy at sea—an attitude that has a certain historical interest in view of the success of German submarines in the present war. Fulton, on his return to America, found no reception for his torpedo and so centred all his energies on the steamboat. Other Americans, however, in the next forty years, enormously improved it. Samue Colt developed the scheme of exploding fixed mines with electricity—now the basis for this effectual form of harbour defence. In the Crimean War the English sufficiently overcame their early hostility to use the submarine mine before Sebastopol; the American Civil War, however, first demonstrated its effectiveness. The Confederates had no navy;

Union gunboats were constantly ascending their rivers, doing enormous damage. The Southerners, therefore, mined their streams, at times using beer barrels filled with gunpowder. These devices proved exceedingly effective, destroying many Northern ships; so effective, indeed, that they aroused the somewhat sluggish interest of European governments, which now began to manufacture submarine mines themselves. And so the Civil War established the torpedo, not only as an effective method of defence, but as an entirely legitimate one. Germany, having then no appreciable navy, protected her coastline in this way in the Franco-Prussian War. Despite this new attitude, European interest still steadily lagged. New inventions—the turreted battleship, the automobile torpedo, the modern strength of land fortifications—seemed to relegate, in the opinion of most European experts, the submarine mines to the scrap-heap. It played little part in the Spanish-American War; the most dramatic episode in that proceeding, indeed, was the successful contempt with which Dewey ignored the possible presence of mines in Manila Bay.

The Japanese War with Russia, however, changed naval opinion on this subject, as it did on many other things. This conflict presented the submarine mine in an entirely new role. Up to that time it had held a certain importance as a method of defensive warfare. Its use was almost exclusively to protect harbours and strategic places on the coastlines. The naval scientists had constructed a large and varied assortment of mines for this purpose. They all worked on the same

essential principle. Fixed mines were placed in the water, at varying distances from the bottom. Electric currents connected these with a secret station on the shore. An operator stationed here

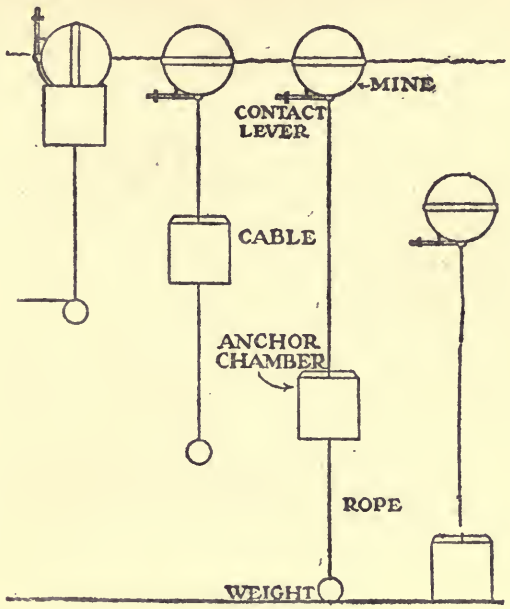


THE MECHANISM OF A MINE

It consists of the mine itself rigged with a lever for setting off the explosives, an anchor chamber connected with the mine by a cable which is as many feet in length as the mine is to be under water, and a weight connected with the anchor chamber.

could fire any mine simply by pushing a button or turning a key. With the whole channel mined and the mechanism in competent hands a hostile ship apparently could cross this field only at an enormous risk. Nearly all nations accepted this

as the proper limitation of mines; their occupation, that is, was purely defensive. The Japanese and the Russians, however, now suddenly began

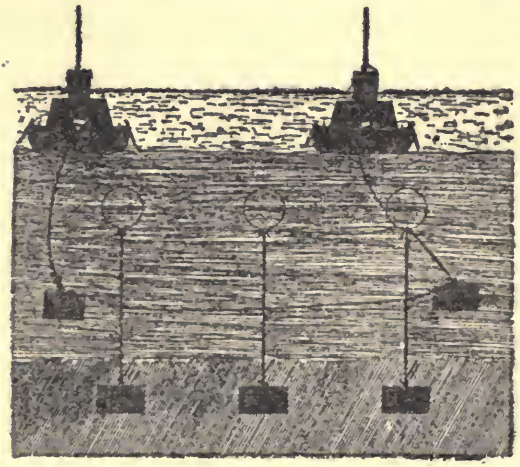


THE POSITION OF A MINE

When the mine is dropped overboard as shown (on the left), the anchor chamber pays out cable and sinks until the weight reaches the bottom (as in the third diagram), which stops the cable from unwinding further and pulls the mine below the surface (as in the right-hand diagram).

to use these insidious machines for an entirely new purpose—for offensive warfare. When this conflict had finished, the submarine mine had taken its place with the battleships, the cruiser, the Whitehead torpedo, and the destroyer as an engine

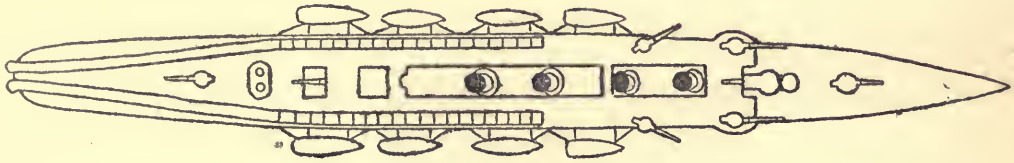
for attacking the enemy. It left the harbours and channels that had seemed to be its exclusive headwaters, and suddenly made its appearance on the high seas. The nations had to recognize this fact, whether they wished to do so or not; the hulks of twenty-four Russian and Japanese warships,



SWEEPING THE SEA OF MINES
Trawlers with a weighted hawser which drags near the floor of the ocean.

scattered all over the Yellow Sea, victims of the skilful use of submarine mines, emphasized this lesson in a way that could not be ignored. By 1903 the British Navy had practically decided to abolish mines. It had disbanded certain minefields that had defended its harbours for years. The experiences of the Russians and the Japanese, however, suddenly changed England's plans.

The Japanese use of torpedoes and floating

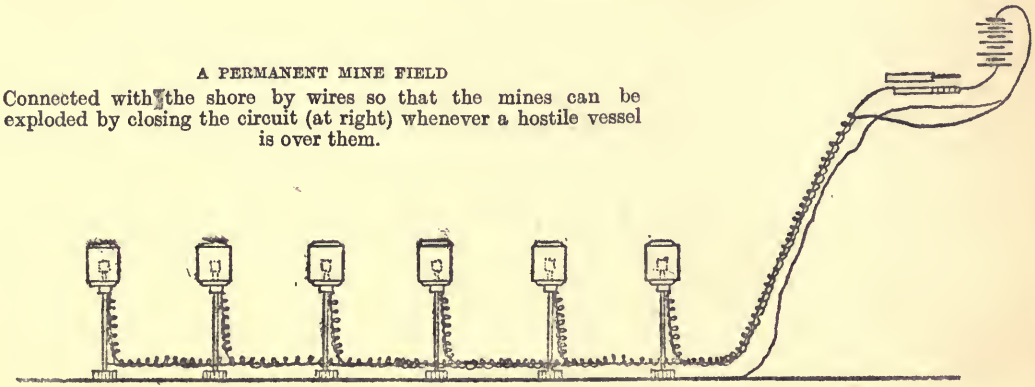


AN ARMED MINE LAYER

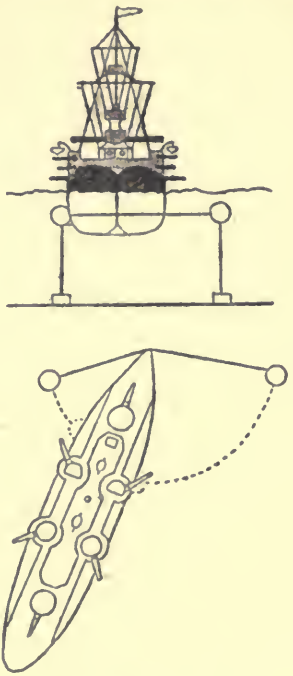
A deck plan showing the mines and the ways from which they are dropped over the stern.

A PERMANENT MINE FIELD

Connected with the shore by wires so that the mines can be exploded by closing the circuit (at right) whenever a hostile vessel is over them.



mines practically destroyed Russian naval power in the Far East. That is, these machines so enfeebled the Russian fighting fleet that it de-



HOW MINES CATCH A SHIP

Mines sown in groups connected by ropes are drawn in on both sides of a ship which is subject to two explosions such as sank the British cruiser *Amphion*.

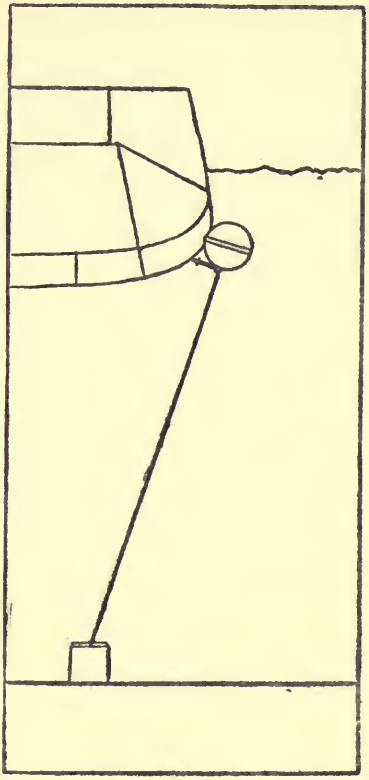
moralized it and reduced it to a ready prey for the Japanese. In all, the Japanese submarine mines destroyed fourteen Russian vessels, these including many of Russia's most powerful fighting units.

The Japanese, however, did not have the whole game to themselves. The Russians soon imitated their tactics and the final reckoning disclosed that Russia had lost fourteen ships this way and Japan ten: a startlingly large number in view of the comparative smallness of both fleets. Mines did greater destruction than torpedo boats—and these, in the hands of the Japanese, accomplished a great deal.

Germany's naval experts had carefully studied the Japanese War and had decided that the floating mines on the high seas formed an indispensable method of offence. The North Sea presented an admirable field for mining operations. It is an exceedingly shallow body of water—averaging perhaps 120 feet; and anchored mines can be placed almost anywhere on it. Germany could not rest content with mining her own coast or even that of England; she proposed to go out into the watery highway itself and string death-dealing machines in the way of British commerce. England on the other hand, has organized a special service in her navy for sweeping up mines.

Germany plans not only to use her mines in this haphazard way, but in actual warfare. Her naval arrangements call for scattering mines in a naval engagement. The idea is to lay them in the way of fighting ships, either to destroy the enemy or compel it to change the course. The German navy regularly practises elaborate manœuvres at this game. The plan is to station a mine-laying vessel in the rear of a regular battle-line. As the German ships approach the enemy this special vessel trails along behind, laying her floating machines. As

they come nearer the British fleet, the main line will make a slight turn. This will leave the mine-



HOW THE CONTACT LEVER WORKS

The mine is so designed that it turns as it slips along the ship's side so that the lever will certainly come in contact with the ship and explode the charge.

field directly in the path of the approaching enemy. The vessels must then either go to their destruction, or make such changes in their formation as to

demoralize considerably the battle arrangements. The Germans also figure that these floating mines will unnerve the enemy; part of the scheme, therefore, contemplates using, not real mines, but wooden dummies painted so as to look exactly like them. Unprejudiced observers, it must be admitted, are not much impressed by this scheme. They point out that mines freely floating in the battlefield, with the ships of both sides constantly manœuvring about, are just about as likely to strike friend as enemy. The necessity of avoiding them is as likely to disconcert one side as the other. However, the Germans claimed to have taken precautions that will secure them against accidents of this kind.

SHARP-SHOOTERS OF THE SEA

In the minds of naval authorities there is little doubt as to what is the most significant development of the war thus far. That is the sinking of five important warships by submarines. On September 1 a German "Unter-see-boote" sent the British cruiser *Pathfinder* to the bottom. A few days afterward a British submarine squared the account by similarly torpedoing the German *Hela*. Then came the most dramatic episode of all: three substantial, though perhaps "obsolete," English cruisers sank, victims of another of these German sharp-shooters of the sea.

This type of sea warfare is practically useless to any Power that "rules the waters." Since the days of Trafalgar England has had a navy at least twice as powerful as that of any other country. In consequence she has lorded it over the ocean. This control is not unenlightened selfishness; it is absolutely a matter of life and death. Without it England sinks into the position of a second- or third-rate Power; she becomes, as Disraeli said, merely "a Belgium at sea." Presumably the English fleet at present, being twice as strong as the German, could defeat the Kaiser's forces; a new method of warfare, therefore, such as the submarine, helps England very little.

Conversely the submarine, therefore, helps chiefly Germany; and Germany has specialized in this branch of her service. Assuming that the submarine were to become supreme in naval warfare, let us follow out the idea to its inevitable conclusions. The German navy, powerful in submarines and skilful in handling them, slowly destroys the British battle-line. The British submarines, equally powerful and equally skilful, retort and destroy the German ships. When the operations are finished, both the British and the German navies are at the bottom of the sea. Superficially this looks like a draw; in reality, Germany has scored a tremendous naval victory—one as great, in its influence, as Trafalgar's. For the net result is this: Germany has really lost nothing except an overpowered navy. England has lost the command of the sea, the one thing absolutely essential to her economic life and her existence as a Great Power.

The British Navy went into the war with a submarine flotilla of 76 ships, with 20 building; Germany has 27, with 12 building. In submarines, as in everything else, the Triple Entente enormously outdistances the Dual Alliance. The figures usually quoted give England, France, and Russia 171 submarines in service and 61 building, a total of 232, whereas Germany and Austria have only 37 afloat and 16 in the dockyards, a total of 53. In other words, the allied Powers have nearly five times as many as their Germanic enemies. England's construction of submarines on a large scale evinces a strange flaw of logic. The submarine, if successful, gives nobody the control of

the sea; it simply takes away such control from any nation that possesses it. England's policy, therefore, in meeting this situation by building submarine boats, is a negative policy. In the minds of most critics, she should have expended her energies and moneys on an antidote to the submarine. Her navy needed no submarines; what it did need was some contrivance that would destroy the enemy's submarines. This England does not have. The torpedo net, protecting the bottom as well as the sides, is one. But this is useless except for vessels that are standing still; it paralyses any ship in motion. Another is to armour plate the bottom of ships. That considerably reduces the speed; and it is also a question how successful it would be.

The main defence against the submarine arises from its own limitations. These limitations are three in number: its limited radius of action, its comparatively slow speed, and its blindness. The first is not so serious a handicap now as it was a few years ago; there are plenty of submarines which can now make a voyage of 2500 miles. The speed question, however, is not yet solved. There are contradictory reports as to their speed; this probably averages, however, about 8 knots under water and 12 above. England's great battle-cruisers, a comparatively new type of vessel, have frequently a speed of 27 and 28 knots. Provided that a surface vessel sees the submarine, therefore, its defence against it is clear enough; it is to run away.

Again, except under particularly favourable circumstances, the submarine is blind. In a choppy

sea, the periscope is not much use. It gets covered with spray, and so reflects nothing except a mist. In perfectly smooth water it shows the presence of the submarine, as it leaves a triangular wake. It is, therefore, likely to be hit. When it sinks and shoots its torpedo, it aims more or less by guesswork. Only occasionally does the bolt reach its mark. The recent accident to the British ships, however, shows that, despite these limitations, the submarine can do fearful damage. To what an extent it furnishes an offset to a huge battlefleet, the next few months should make plain.

J. M.

SUBMARINE DESTROYERS

It is not unlikely that we shall have very soon a new type of vessel, the SUBMARINE DESTROYER, *which will be submersible, or partially submersible. It will be specially designed for ramming submarines, and will be a speedy and easily manœuvred vessel.*—EDITOR.

THE SUBMARINE

A LITTLE while ago the term "submarine" was applied only to vessels that could properly be described as boats; to-day the largest submarines, the "E" size, are larger than very many of the sailing tramps that were to be found all over the world before the development of steam. They are as large as some of the smaller cruisers. The latest French submarine is as large as many ocean steam tramp steamers, and the "F" class projected for this country are reported to be larger still. Their development has been comparatively rapid. By submarine is meant, a vessel which can live and move about under the water, just as a fish does. Its great object is for offensive purposes in war time. The brilliant French writer, Jules Verne, is credited with the first idea of the submarine; but something of the kind was tried in the American Civil War, and successfully, so far as the object to be attained was concerned, viz. the destruction of the enemy; but unfortunately the submarine itself was also usually destroyed.

The modern submarine has been more correctly described as a submersible; that is to say, it can be submerged if desired. In practice it floats upon the water, and is intended to get within reach of its quarry, of the vessel to be attacked, while

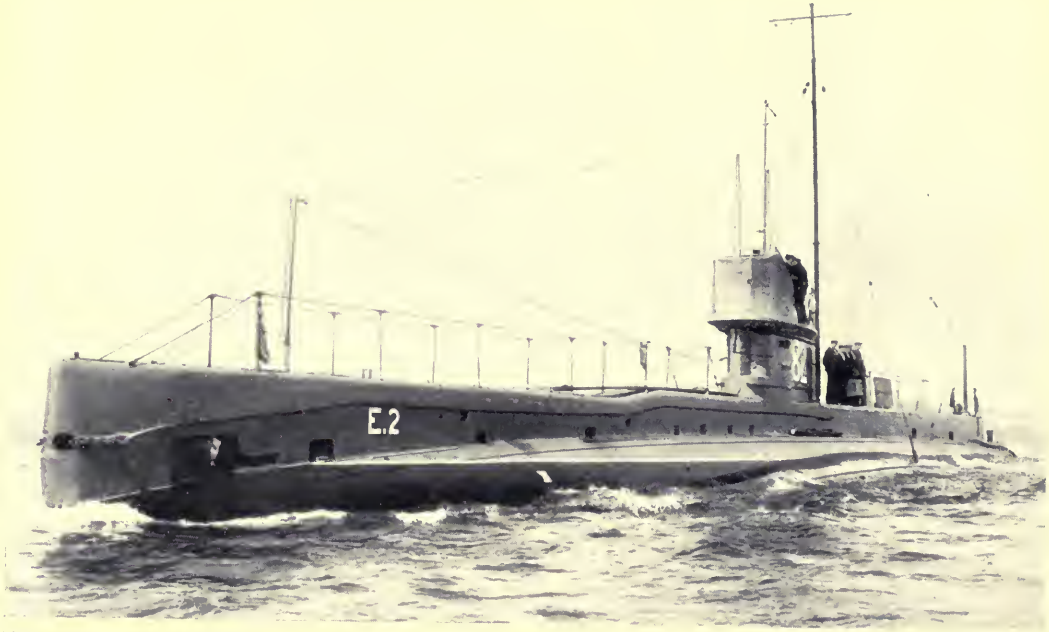


Photo *S. Crebb, Southsea*

ENGLAND'S LARGEST SUBMARINE

running on the surface ; then to dive, get within very close quarters and discharge its torpedoes. The submarine or submersible is intended entirely for discharging torpedoes at an enemy's ship.

It is propelled when floating on the surface by petrol, or paraffin, and in the latest forms by Diesel engines. Some serious accidents have occurred

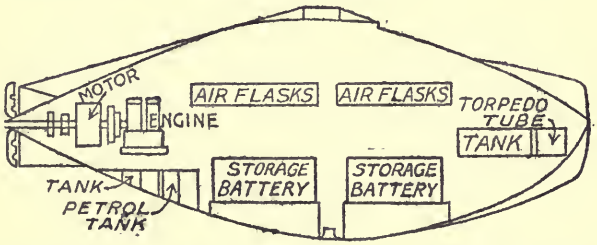


FIG. 1. Diagram showing the arrangement of the interior of a submarine. The observer is supposed to be looking down upon the inside of the boat from above.

from the vapour of petrol taking fire. When under water the submarine is propelled by electric motors, taking current from a battery of electrical accumulators. Both when on the surface and when under water the vessel is driven by screw propellers, carried at the stern, just as any other vessel. It has an ordinary rudder for turning its head to starboard or port (to right or left), and in addition it has one or more horizontal rudders, somewhat similar to those carried by dirigible balloons, and by aeroplanes, the object of which is to direct the vessel's head up or down. When on the surface the screws are driven by the engine, and when submerged by the electric motors. The engines also drive the electric motors, or generators,

the current they furnish being used to charge the accumulators. Some serious accidents have taken place in connexion with the gas given off by the accumulators.

In addition to the horizontal rudders mentioned above, the submarine is fitted with tanks on each side, which are filled when she is to dive, and which

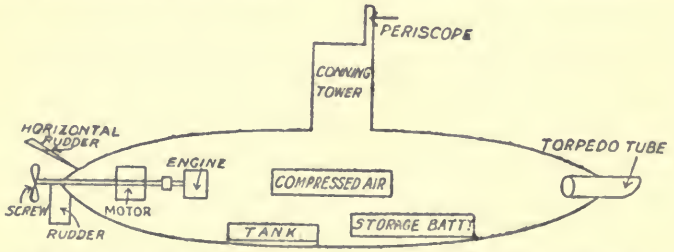


FIG. 2. Vertical sectional diagram of a submarine. The observer is supposed to be looking at the interior of the vessel from the side.

are pumped out by the aid of the electric motor or blown out by compressed air when she is to ascend. Fig. 1 is a diagram showing the interior of a submarine as it appears when looked at from above ; and Fig. 2 what is called a vertical section as it appears when looked at sideways.

When she is to dive she forms a completely enclosed vessel, something in the shape of a cigar ; but with what is called a conning tower, rising from about the centre of the length. The conning tower is practically a large funnel leading from the outside into the body of the vessel. When the vessel is to be submerged, when she is exercising, and when she would be in action in war time, her commander stands on a platform arranged for him inside the

Photo *S. Cribb, Southsea*

WHAT A SUBMARINE LOOKS LIKE WHEN OUT OF WATER

The A 12 aground—waiting for the tide to float her off

conning tower, from which he gives his orders to the helmsman, and the remainder of the crew under his charge.

As the submarine descends, the conning tower also is closed down the last thing, before that also is submerged; and it is of the utmost importance that the whole vessel shall be absolutely water-tight.

When the submarine is on the surface it presents a very peculiar appearance, as shown in the photographs. Submarines may be seen sometimes lying in Plymouth Sound and elsewhere, moored between two buoys, one at the head and the other at the stern; and they look much like rafts. Their decks are protected by "life lines," run through holes in iron stanchions, fixed in the top of the vessel. When she descends all this top hamper is stowed below. The space enclosed between the "life line" ropes constitutes the only promenade deck available for the officers and crew when they are on board.

It is, of course, of great importance that air shall be available for the crew, which is becoming larger and larger as the submarine itself becomes larger and larger. Compressed air is employed. A tank arranged for the purpose has a supply of compressed air forced into it, while the engine is running on the surface; and the air is let out into the body of the vessel, when she is below the surface, through what is termed a reducing valve: a valve which reduces the pressure of the air to that at which it can be breathed comfortably, and at which its use is economized. The compressed air is also sometimes employed to blow out the ballast tanks.

When the submarine is to go down, the procedure is as follows : The crew are all ordered below ; all top hamper, as seamen call it, is cleared away ; and the commander takes his place in the conning tower, with the cover open. The ballast tanks are then filled, great care being taken that the vessel sits on an exactly even keel. The crew also have to be in their places before the dive is commenced, and they are not allowed to move about, more than is absolutely necessary, while she is below the surface. One great danger to which submarines are liable is an overbalance—the possibility of her turning turtle, if she got what sailors call a " list " to one side, and some motion of the waves on the other side increased it. Further, any motion of the men below, when she is under water, causes a good deal of rolling. When all is ready the order is given, " Prepare to dive " ; the conning tower is closed ; the electric motors are started to run, the engine having been stopped when the men were ordered below ; and the horizontal rudder is turned downwards. It is the pressure of the water against the horizontal rudder, as the vessel moves through the water, which causes her nose to turn downwards.

When at the required depth the horizontal rudder is turned upwards slightly, and she remains at that level. When it is desired to come up the ballast tanks are emptied and the horizontal rudder is turned upwards.

How the Submarine Sees its Way

One of the greatest difficulties in connexion with the submarine was, in its early days, and is still to a certain extent, the fact that it is practically blind.

Photo *S. Cribb, Southsea*

THE MARVELLOUS EYE OF THE SUBMARINE

The periscope is the tube that projects above the waves and enables its officers to see what is taking place on the water. Observation may be made by the officer down below sitting in a chair

The blindness is overcome, to a certain extent, by a little apparatus called the periscope. This is a tube projecting from the conning tower up to the surface of the water, and slightly above it. It carries an

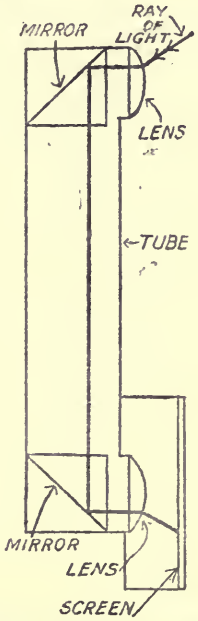


FIG. 3. Diagrammatic section of a periscope; the apparatus by which the officer in command of a submarine is able to guide his vessel.

arrangement of lenses, by which a picture of surrounding objects covering an arc of about 60° is given, as in a camera, to the commanding officer below. By turning the periscope round he can obtain a view all round the horizon, just as with a telescope. In the latest form of submarine there are usually two periscopes. It will be obvious

that a very much better look-out can be kept by two officers, handling two periscopes, than by one.

The periscope is believed to be practically invisible to the signalman of any ship a submarine was intending to attack. On the other hand, the motion of the waves tends to obscure the vision obtained by the periscope itself. It will perhaps be sufficient to say that the development of this branch of the work is in its infancy. Fig. 3 is a diagram explaining the action of the periscope.

How the Submarine is Guided under Water

Ships floating on the surface, as is well known, feel their way across the great ocean by the aid of the mariners' compass. Two methods of guiding submarines when under water are adopted, one by the aid of a compass specially designed for the purpose, and the other by the aid of the gyroscope.

The special compass is an adaptation of Lord Kelvin's compass, the invention of Captain Chetwynd. It has a very light compass card, with very light steel magnets, floating in a liquid in a bowl provided for it. In the compass for submarines the card is transparent, and by a system of lamps, lenses, and mirrors two magnified images are given inside the hull, one for the officer in command and one for the steersman. The apparatus itself is fixed outside of the vessel, the reflected image of the compass card being obtained through a vertical tube. The gyroscope is another instance of a toy becoming a practical instrument. It is virtually a spinning wheel. Most of us remember buy-

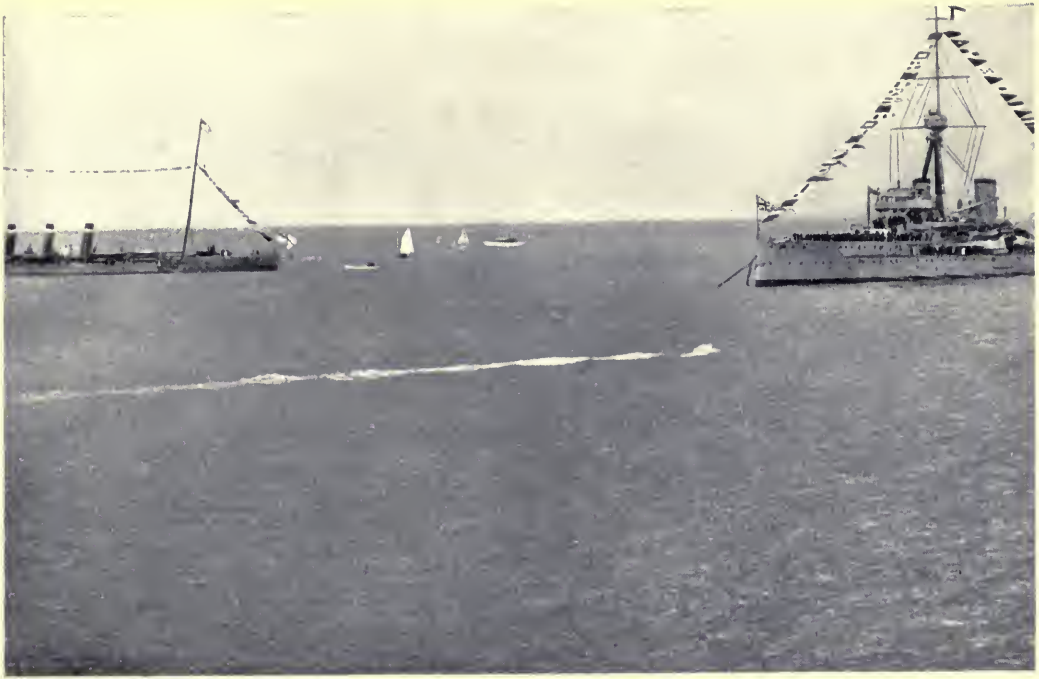


Photo *S. Cribb, Southsea*

THE TRACK MADE BY THE PERISCOPE OF A SUBMARINE SUBMERGED
About 27 men are below here

ing a top in the shops, setting it spinning, and noting its gyrations. The particular feature which makes it of service as a compass is the fact that it resists being turned out of the plane in which the spinning wheel is revolving; and this resistance is made use of in the compass to show where the

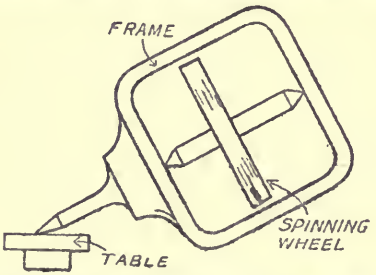


Fig. 4. Diagram of a gyroscope. It resists any force tending to turn it out of the line in which it is moving.

north lies, and the point of the compass to which the ship's head is directed. Fig. 4 is a diagram of a gyroscope. It will be easily understood what a great boon the gyroscope compass is to the submarine. It may be fixed in any part of the ship. In practice, all the instruments are under the eye of the commander of the submarine, or his second in command; and all orders are given by the commander to the steersman and the others who have to carry them out.

Discharging Torpedoes from a Submarine

As mentioned above, the great object of the submarine is to discharge a torpedo at a large ship of war, or any other object, such as a transport carrying troops, that is to be destroyed. For this

purpose what are called torpedo tubes are fitted to each submarine. The early "A" class had only one tube; the "D" class have two tubes in the bows of the ship, and one tube in the stern, so that it is possible for a submarine of this class to approach a battleship, say, discharge the two torpedoes in the bows, turn round and discharge the third torpedo from the stern as it is retreating. The

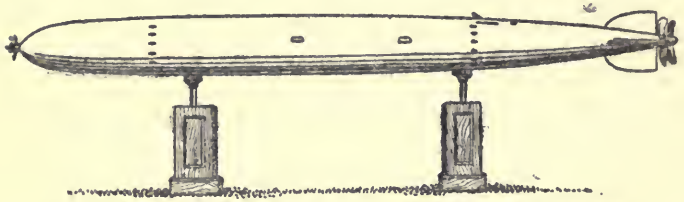


Fig. 5. Diagram of an eighteen-inch Whitehead torpedo.

torpedo tube is merely a tube fitted in the bow or stern as the case may be, its end projecting a little way beyond the vessel, proper arrangements being made that water does not enter. The Whitehead torpedo is pushed into the tube, through what is called the breech, the inside end. It is expelled from the tube by the aid of compressed air, furnished from the reservoir already mentioned. When not in use the torpedoes, one or more for each tube, lie in racks arranged for them, and they are lifted out by hand, just as shot and shell are, and pushed into the torpedo tube, just as a shell is pushed into the breech of a gun.

The Armament of the Submarine

The torpedo is the primary armament of the submarine, but the "D" class and the "E" class,

Photo *S. Cribb, Southsea*

SUBMARINE ATTACK

The wake of the torpedo. The cross indicates the point at which it was discharged by the submarine submerged

it is understood, will carry small guns, arranged to disappear, in somewhat the same manner as with some guns inside forts. The guns will, of course, only be used when the submarine is on the surface; and they will be fixed in a special receptacle built for them, forming part of the submarine, but arranged to be closed over when the vessel is below the surface; and hoisted up to a sufficient height to enable the gun to be fired when the vessel is above. The object of the guns, which are only small, is to enable submarines to defend themselves from other submarines similarly armed, and from some of the smaller torpedo craft, the torpedo-boats and torpedo destroyers, also from boats, launches, and others dispatched by the big ships. The "G" class are reported to be small submarine cruisers, that will accompany the fleet, and will have a displacement of 1500 tons or thereabouts.

Communicating with the Submarine

The larger forms of modern submarine all carry wireless-telegraph apparatus, which is rigged up on masts provided for the purpose, but which can only be used when the vessel is floating on the surface. When she is to dive, as explained above, all top hamper, everything above the deck except the conning tower, is stowed away below. The wireless apparatus is, however, of considerable service for directing the movements of the submarines from the "mother" ship. It is usual for submarines to work in connexion with a small cruiser called the "mother" ship, and it is of importance for them to be in continual communica-

tion with her; and this is accomplished by the aid of wireless apparatus. There are considerable difficulties in working wireless apparatus in connexion with a submarine, but the whole problem of the submarine is very difficult.

Apart from the wireless apparatus, there is no means of communicating with the submarine except the telephone buoy, as it is called. German submarines are all fitted with one or more telephone buoys: buoys to which telephones are attached, and which are connected by flexible metallic conductors, enclosed in tubes, to protect them from the water, with the inside of the submarine. In case of an accident, the buoy detaches itself from the submarine and floats to the surface; and the "mother" ship, another submarine, or a boat can communicate directly with those in the submerged vessel. The use of the telephone buoy was the means of saving the lives of the crew of one German submarine some little while back.

Life-saving Apparatus for the Crew of a Submarine

With the early forms of submarine, the "A" class, there are no means of saving life. If one of them goes down, unless the fact is discovered very soon and very prompt measures are taken, the crew are doomed. There are no means for the crew to escape, and there are no means of communicating with the crew. With the latest forms, however, special apparatus has been worked out, by Messrs. Siebe, Gorman and Co., by which the crew can escape from a submarine that is held on the bottom, for instance, and can float to

Photo *S. Cribb, Southsea*

SUBMARINE B 4

The B Class Submarines are now fitted with wireless, and in the present war this will greatly benefit these under-water boats to get into touch with the Fleet

the surface. An air lock now forms part of the equipment of the submarine. The air lock is a chamber with doors at each end, arranged so that only a small quantity of air or water can enter each time the lock is opened. When using the air lock the men dress in a special form of diving dress consisting of a helmet, and a waterproof dress extending to the waist, and designed to keep out the water for a certain time from the upper part of the body. Each member of the crew in succession dresses in one of these; climbs into the air lock, closes the door below him; then opens the door above him, and by the aid of the dress, floats to the surface, closing the door of the air lock behind him. By use of this arrangement it is hoped that many if not all the lives of the crews of submarines that meet with accident under water may be saved.

The Dangers of the Submarine

The dangers of the submarine are many. The whole vessel itself is constructed of very thin iron or steel. It is of importance that its weight should not be great, as it must have a certain amount of buoyancy when floating on the surface; and the more weight that is locked up in the hull itself, the smaller is the buoyancy, or the smaller is the crew or machinery that can be carried. With the development of the submarine more and more machinery is being carried and therefore greater and greater buoyancy is required. An ever-present danger therefore is the striking of the submarine upon a rock. It will be remembered that the vessel is practically blind as to anything that is

under water, and it may therefore strike a rock, one of those jagged forms that one sees so often round our coast, by which a hole would be quickly made, the water forcing its way in. The submarine has one important chance against the entry of water. The amount of air within it being strictly limited, the entrance of the water from the sea compresses the air, and is thereby checked, when it has risen to a certain height. So it may happen that if the hole in the submarine is not great, the crew may not be in any danger provided they are able to escape through the air lock. If the rent is big, however, as may easily happen, they are likely to be drowned before they have the chance of escaping.

Another danger is the possibility of her striking a muddy bottom and being held there. This is not such a serious danger. Other dangers arise within the submarine itself. With petrol-driven vessels there is always the danger of an escape of petrol. The vapour of petrol has a very peculiar effect, somewhat intoxicating, and in the end poisonous. There is also the more serious danger, that if an atmosphere of petrol vapour and air is formed within the vessel, a spark from one of the switches controlling the electrical apparatus might fire it. The limits of explosive mixtures with petrol are from 3 per cent. to 5 per cent. of petrol vapour, in any given volume of air.

S. F. W.

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AEROPLANE AND SUBMARINE

It is well known that the submarine, although when submerged invisible to an observer or "look-out" on the deck of a warship or other vessel, is clearly visible, and may be readily located by an aeronaut from a sufficient altitude. The conditions are similar to those frequently noticed when fish in a river are seen clearly from a bridge, but are invisible from the river-bank. The torpedo-boat or destroyer when operating against the submarine is at a considerable disadvantage, inasmuch as when the latter is submerged the only visible sign of its presence is its periscope—a pole of a few inches in diameter, projecting some 8 ft. or 10 ft. out of the water. Ordinarily it is the point where the periscope "rips" the surface that forms the most conspicuous visible indication. Thus we may anticipate that in the future operations directed against the submarines of an enemy will involve the employment of aircraft, at least as a means of reconnaissance. It is an important fact that in this particular service the enemy (the submarine) has no power of offence; hence it is possible that the dirigible may prove itself as well suited to the work as the aeroplane. It is true that the modern submarine is being fitted

with guns of light calibre, but these are only available after the vessel has come to the surface. We may presume that in any operations of the description contemplated one or more destroyers or light cruisers will accompany the aircraft scout, and the conning-tower of the submarine will be blown away within a few seconds of its making its appearance. It is not in any sense certain or likely that the operations of aircraft in relation to the submarine will be confined to observation. In the opinion of the writer, aircraft, whether aeroplane or dirigible, will prove to be the submarine's most deadly enemy, the submarine being attacked by bombs charged with high explosive while submerged. Owing to the absence of any danger of counter-attack the aeroplane may fly as low as deemed desirable to obtain the necessary accuracy of aim, and much of the difficulty commonly associated with bomb-dropping will accordingly vanish.

The type of bomb appropriate to the duty in question, although not greatly different from that required in connexion with land service, will need a certain amount of consideration. In view of the fact that the size of the hole blown in the skin of the submarine is not important, the charge of explosive may be quite moderate; probably 10 lb. or 15 lb. of wet gun-cotton will be ample. A bomb of torpedo-like form, about 6 in. in diameter, and fitted with a sheet-metal cruciform tail, would probably be found suitable; it would be furnished with a positive impact or contact fuse at its nose. The correct way of dropping a bomb of this type is broadside on, pointing in the direc-

tion of flight; the axis then remains tangent to the trajectory throughout the fall, the tail acting in the manner of the feathering of an arrow.

A bomb of the type described in the preceding paragraph will travel through water under the influence of gravity at a no inconsiderable velocity. Taking its weight to be (immersed) about half a hundredweight, its limiting velocity in water will be about 50 ft. per second, which is ample to ensure the certain action of the contact fuse. Thus it will be impossible for a submarine to escape by deep immersion, presuming it to remain sufficiently visible to permit of attack.

In brief, the aeroplane, and to some degree other aircraft, suitably armed, may be expected to prove an effective check on the unbridled activity of the submarine. With a properly equipped naval aeroplane service, supported by a few fast, light cruisers, such as the type known as the "destroyer leader," the enemy's submarines will be unable to roam at large or to make unexpected attacks on our cruiser patrols. They will need to operate under the protection of a supporting force, and will only leave that protection at the risk of almost certain destruction. Or they will require to confine their activities to raiding by night—a form of activity in which their radius of action is essentially limited, and, save under exceptional circumstances, of doubtful promise. It must not be assumed, however, that the service necessary for the effective patrolling of the seas by aeroplane will prove at all a simple or easy matter. The provision of the needed bases, coastal and floating, alone will be a formidable matter, and as the radius of action

of the submarine is increased, and the field of operations is thereby widened, the work will become more and more arduous. Again, the enemy's aircraft will always have to be reckoned with. Thus, although the air service may be looked to to provide an effective limit to the power of the submarine, we can never expect or anticipate that the value or utility of the latter will be by any means nullified.

F. W. L.

[From "Aircraft in Warfare: The Dawn of the Fourth Arm," by F. W. Lanchester, M.Inst.C.E., published in *Engineering*.]